UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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AUG 8 2003

OFFICE OF
AIR AND RADIATION

Dr. Inés Triay, Manager
Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221-3090

Dear Dr. Triay,

I am writing regarding the Department of Energy (DOE) policies and practices in determining whether waste meets the definition of transuranic (TRU) waste and is therefore eligible for disposal in the Waste Isolation Pilot Plant (WIPP). It has been the understanding of the Environmental Protection Agency (EPA), and our assumption in practice, that DOE sites made this determination on individual waste containers as they were assayed for radioactive components through the waste characterization process at generator sites. However, it has recently come to our attention that certain waste generator sites have been making this determination by combining assay data and using averaging techniques over multiple waste drums, some of which do not meet the TRU waste threshold when considered individually.

We have evaluated in detail DOE's load management policy allowing waste generator sites to make the TRU waste determination on a payload container basis. We have examined the underlying legislation, EPA's applicable radioactive waste characterization regulations, selected DOE Orders and policies, and technical documents and procedures related to waste characterization. Our detailed analysis is provided in Enclosure 1 to this letter. In summary, our conclusions are:

- The policy of making the TRU waste determination on the basis of payload containers is not precluded by the WIPP LWA, EPA's regulations, or DOE's policies and procedures. It is a reasonable interpretation of the applicable legislation and regulations, and is acceptable if implemented in a technically adequate manner. The technical aspects of this practice from the perspective of implementing waste characterization at generator sites and of long-term performance of the WIPP have been partially addressed but not fully resolved.
- Containers shall be eligible for overpacking for load management only if they belong to waste streams that have been identified and managed as TRU waste.

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- In order to address the possible impacts of increased use of ten-drum overpack containers on long-term performance of the WIPP, DOE must ensure that the potential effects on updated waste inventory estimates and creep closure mechanisms are incorporated in the performance assessment performed for the upcoming WIPP recertification.
- In general, we expect that Acceptable Knowledge (AK) can be used to identify containers that individually do not meet the 100 nCi/g threshold so long as AK is not used to justify numerical values for radionuclides falling below the lowest level of detection (LLD) for non-destructive assay (NDA) instruments used to confirm AK. In those cases, a character string such as "<LLD" shall be used for the purpose of tracking radionuclide inventories. Comparable AK should be provided for all drums in a waste stream, whether or not they are expected to meet the TRU threshold individually. We will continue to assess the adequacy of AK on a site-specific basis under our §194.8 approval process.
- NDA systems are technically adequate for identifying and quantifying radionuclide content of waste drums for disposal at WIPP only when the measured activities of individual radionuclides and quantities derived from measured radionuclide activities (1) exceed the minimum detectable activity (MDA) and (2) are within the calibration and approved performance ranges of the instrument. We will continue to assess the adequacy of NDA equipment on a site-specific basis under our §194.8 approval process.
- At the Savannah River Site – Central Characterization Project (SRS-CCP), the IQ3 system (in combination with AK) is approved for characterization of radionuclide content over its full operating range. The IPAN system is restricted to drums exceeding the 100 nCi/g threshold.
- At Argonne National Laboratory – East (ANL-E), the IPAN system is restricted to drums exceeding the 100 nCi/g threshold.
- Drums that show no measured values exceeding MDA for any transuranic isotopes shall not be disposed in the WIPP.

We will continue to assess the documentation and implementation of this practice at DOE sites and in the WIPP Waste Information System (WWIS) in future inspections. Nothing in this letter or enclosures shall be read to allow DOE to make a TRU waste determination on any scale greater than the payload container (such as on a waste room or panel basis).

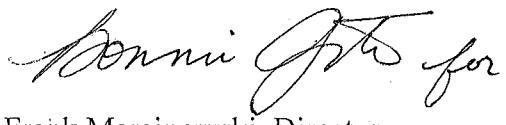
Some amount of waste characterized with the IPAN system and overpacked into ten-drum overpack containers has already been emplaced in the WIPP. It belongs to waste streams approved for disposal from SRS-CCP and Argone National Laboratory-Central Characterization Project (ANL-CCP). While we have concerns that it may have been characterized outside the range that we now believe is adequate, our approvals for the equipment at the time did not specify a limit on its use for the identified waste streams. Most importantly, the radionuclide levels are below those averages assumed in the certification performance assessment. Furthermore, the NDA issues do not affect the assessment of non-radioactive components that could affect performance. Therefore, there is no reasonable basis to expect that it would adversely affect WIPP's long-term

performance; and its retrieval could pose significant operational difficulties and lead to unnecessary worker exposures. For these reasons, waste already emplaced in the disposal system shall not be retrieved. However, DOE shall provide an inventory of those ten-drum over pack (TDOP) containers previously characterized with the IPAN system from SRS-CCP or ANL-CCP, identifying drums that fall below the 100 nCi/g threshold when considered individually.

Finally, we have significant concerns that this practice was implemented without prior notification to EPA. While the use of overpacking to control contaminated or damaged drums was described in the certification and associated waste characterization documents, EPA was not provided written notification that the practice was being expanded to other purposes that could affect waste characterization and tracking of radionuclide inventories. Similarly, the change was not highlighted in inspections at either of the sites implementing this practice. Advance notification of EPA, and our full involvement in assuring the regulatory and technical adequacy of this approach from its inception, would have alleviated many of the concerns now being addressed. To avoid the recurrence of such a situation, DOE must notify EPA specifically of the use of such overpacking and averaging techniques at any and all sites where it is applied in the future.

If you have questions regarding this matter, please contact Betsy Forinash at 202-564-9233.

Sincerely,



Frank Marcinowski, Director
Radiation Protection Division

Enclosures

cc: w/Enclosures:
Matt Silva, EEG
Steve Zappe, NMED
Lynne Smith, DOE HQ
Reinhard Knerr, DOE CBFO

Enclosure 1: EPA Analysis of DOE's Policy Regarding Management of TRU Alpha Activity Concentration – August 2003

DOE TRU Activity Management Policy

As you are aware, waste disposed in the WIPP must meet the criteria for TRU waste as defined in the WIPP Land Withdrawal Act (Public Law 102-579, as amended by Public Law 104-201) (WIPP LWA):

> The term "transuranic waste" means waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for—
> (A) high-level radioactive waste;
> (B) waste that the Secretary has determined, with the concurrence of the Administrator, does not need the degree of isolation required by the disposal regulations; or
> (C) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with part 61 of title 10, Code of Federal Regulations.

[Sec. 2(18)] It has been the practice at most DOE generator sites to make the determination regarding TRU waste (i.e., confirm that transuranic isotopes exceed the 100 nanocuries/gram (nCi/g) threshold) on individual waste containers as they are assayed for radioactive components using non-destructive assay (NDA) as part of the waste characterization process. Our inspection and approval of waste characterization equipment and procedures has been premised on this assumption.

Recently, we became aware that several sites were making this determination on the final certified payload container—that is, at the time of packaging for shipment and emplacement rather than at the time of assay. The payload containers to which this is applied include the ten-drum overpack (TDOP). In this configuration, unopened undamaged drums of waste are overpacked into a TDOP container; assay is performed on individual drums prior to overpacking and the activity is summed over the entire overpack container to assure the total radionuclide concentration meets the WIPP Waste Acceptance Criteria (WAC) and the requirements of the WIPP LWA. To our knowledge, this practice has been applied to date only to debris waste characterized by the Central Characterization Project (CCP) at the Savannah River Site (SRS) and Argonne National Laboratory-East (ANL-E).

The practice of managing TRU activity concentrations on the basis of payload containers was described by DOE in a white paper provided to EPA (see Enclosure 2). In summary, for situations involving overpacking, DOE stated that:

- DOE's National TRU Program complies with the limit established in the WIPP LWA by ensuring that each payload container disposed at WIPP is greater than 100 nCi/g TRU activity.
- An Acceptable Knowledge (AK) Summary Report is prepared for the TRU waste stream that identifies all the individual containers generated by the process or activity.

- Individual waste containers are assayed and must meet data quality objectives.
- Drums are identified as having TRU alpha activity concentrations above 100 nCi/g; less than 100 nCi/g but above the lower limit of detection (LLD) for the NDA equipment; or below the LLD.
- Data entered in the WIPP Waste Information System (WWIS) for each drum includes the TRU alpha activity concentration.
- The Waste Certification Official selects individual waste containers to be overpacked into a larger payload container (e.g., TDOP).
- The TRU alpha activity concentration for the payload container is calculated by summing the concentrations of the individual waste drums contained within the overpack. If the measured TRU activity for individual waste containers within a payload container is above the LLD, the actual measurement is used to calculate the activity concentration in the payload container; otherwise, a value of zero is assumed for the individual waste container.
- This method of calculation is described in the *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (CH-WAC) (Section 3.3.3)

Finally, you emphasize that drums are eligible for such overpacking only if they belong to waste streams that have been designated and managed as TRU waste. Furthermore, NDA must confirm the presence of transuranic elements within the waste container. The policy description states that waste containers that show no indication of transuranic elements are rejected from the waste stream and returned to the host site for disposal elsewhere.

Legal and Regulatory Analysis

In assessing the legal and regulatory standing of the practice of applying the TRU threshold to the payload container versus assayed container, we have evaluated its consistency with the governing legislation, applicable EPA standards for radioactive waste disposal at WIPP, and selected internal DOE procedures and policies.

The WIPP LWA establishes the definition for TRU waste that is eligible for disposal but does not specify how the definition is to be applied. The underlying radioactive waste disposal standards at 40 CFR Part 191 reiterate the definition of TRU waste to which the standards apply but do not specify how it is to be assessed. Similarly, EPA's WIPP Compliance Criteria at 40 CFR Part 194, Section 24, require the "limitations on transuranic waste disposal described in the WIPP LWA" [§194.24(g)] to be met for the waste emplaced in the disposal system but do not elaborate on how they are to be interpreted or applied.

Thus, a reading of the applicable legislation and EPA regulations for radioactive waste disposal does not rule out DOE's policy a priori. Given the lack of specificity in the WIPP LWA, the TRU waste determination could theoretically be made at any level ranging from the total inventory in the WIPP to individual pieces of debris within a waste drum, but applying the definition at either of these extremes would be an unreasonable interpretation with unacceptable consequences in practice. Making the determination at

the inventory level could lead to high uncertainty with the significant possibility of allowing waste that is inconsistent with the WIPP mission established by Congress, while application at the debris level could entail unnecessary worker exposures with the possibility of eliminating a significant amount of waste intended by Congress to be encompassed in the WIPP mission. Removing the extremes, however, still leaves a range of possible options at which the TRU determination can be made reasonably. This range certainly includes determination at the point of assay, when radionuclide content is measured and containers can be easily segregated, DOE has applied this approach at most of its waste generator sites. After consideration, and given that the WIPP LWA is silent on the issue and that EPA's waste characterization requirements make multiple references to "emplaced waste," we conclude that it is reasonable to make the TRU determination on a payload container that will disposed as a single unit in the WIPP, and to do so at the waste generator sites prior to shipment, would ensure that each container emplaced in WIPP meets the LWA limits.

An additional regulatory issue is whether the practice is consistent with the waste characterization procedures and documents which apply within DOE and/or were presented to EPA either during the certification or in subsequent waste characterization inspections for DOE generator sites. To the extent that these were approved by EPA, they also represent binding commitments on the part of DOE. Upon review, we have determined that while the policy of overpacking and making a TRU waste determination over multiple drums is not always clearly established in these documents as a primary method, it is not inconsistent with their contents and requirements. The TDOP was approved as a certified payload container during WIPP certification and is allowed for disposal in WIPP. As noted in your memo, the WIPP CH-WAC describes the method to calculate TRU alpha activity concentration for a payload container. The DOE Order 435.1, *Radioactive Waste Management*, and its attendant *Radioactive Waste Management Manual* provide only broad requirements for waste management that do not conflict with the stated policies. Finally, the CCP TRU waste certification plan narrowly defines overpack (to be used for control of a contaminated or damaged container, without reference to other uses) but otherwise is not inconsistent with the TDOP practice.

Based on the analyses discussed above, we conclude that the practice of assessing TRU waste concentration on the payload container (including TDOP configurations) is an acceptable practice from a regulatory perspective, if implemented in a technically appropriate manner. We emphasize that this conclusion is valid from our perspective only when the conditions you have outlined in your policy hold true: e.g., that waste belongs to waste streams that have been identified and managed as TRU waste, and drums that do not exhibit the presence of any TRU isotopes are rejected from the waste stream. Outside these bounds, the disposal of this waste (even if it can be made to meet the activity threshold through averaging techniques) would be inconsistent with Congressional intent regarding WIPP's mission and likely with DOE's own waste management orders and policies.

Technical Issues: Long-Term Performance Implications

There are several issues that must be addressed in order for DOE to demonstrate that the overpacking process and TRU activity determination are implemented in a technically defensible manner. They include implications for both long-term performance of the WIPP and more immediately, for waste characterization procedures and equipment.

For long-term performance, the aspects of concern are (1) potential impacts on the waste inventory, for both radioactive and non-radioactive components, and (2) behavior of the waste disposal rooms with a high proportion of TDOP containers. In terms of the waste inventory, DOE must document that the waste streams to which this method is being applied were included in the waste inventory estimates provided in the certification decision. If they were not, DOE should address how their inclusion will affect the waste inventory for overall volume of waste and for amounts of both radioactive components and non-radioactive components important to containment (e.g., cellulosics, plastics, and rubber). Furthermore, the waste inventory provided for the upcoming recertification of the WIPP must be updated to include this waste, and the recertification performance assessment used to assess the impacts of any anticipated changes to the inventory from these waste streams.

Second, DOE must assess the potential effects on waste disposal rooms and creep closure mechanisms from disposal of TDOP containers. While the TDOP was approved as a payload container, modeling of the WIPP's performance was based on an inventory composed almost exclusively of 55-gallon drums stacked in seven-drum configurations. The current practice increases the proportion of TDOP containers above the level that would be expected if TDOPs were used solely for damaged or contaminated drums, which comprise a small percentage of the waste streams. DOE must assess how the new practice would affect the number and proportion of TDOP containers emplaced in WIPP. In addition, DOE must evaluate the compressive properties and other relevant materials characteristics of a TDOP compared to 55-gallon drums, and address how this could affect creep closure rates and effectiveness. We expect that this analysis may include additional modeling. Again, this updated information reflects actual waste emplacement practices and inventory amounts compared to estimates provided in the initial certification. The recertification is the appropriate mechanism to assess such updates, and we expect that the recertification application and performance assessment will explicitly include this information.

Waste Characterization Procedures and Equipment

I emphasize that while we have concluded that the TRU waste determination reasonably can be applied at the payload container, in our experience it has been the practice at most DOE sites to make this determination during waste characterization at the point when radionuclide contents of a drum are measured. When inspecting waste characterization programs at waste generator sites, it has been our working assumption that this latter practice was being used. During site inspections, we routinely assess the

adequacy of acceptable knowledge and NDA equipment (including the development of lower limits of detection). However, given our previous understanding that drums measuring below 100 nCi/g were routinely segregated for disposal at facilities other than WIPP, our inspections have focused on whether these methods affect the validity and accuracy of NDA and other processes at activity levels above 100 nCi/g and on the capability of these methods to distinguish between waste that is above or below that level. Whether or not explicitly stated in our approvals or inspection reports, our site evaluations have been premised on the assumption that the techniques would be applied only to assayed containers that individually meet the TRU threshold of 100 nCi/g.

Waste characterization procedures that address primarily non-radioactive components relevant to WIPP's performance and EPA's waste characterization requirements are not likely to be affected by the determination of TRU activity level on a payload container because waste material parameters are still reported and tracked on an assayed container basis. This is especially true given that the waste subject to the expanded overpacking policy belongs to TRU waste streams that were generated by the same or substantially similar processes and have common waste material characteristics. Thus, the waste characterization procedures and equipment of most interest for the TRU determination are those that relate to the identification and measurement of radionuclides, including transuranic isotopes. These are AK and NDA.

Acceptable Knowledge

In the CH waste characterization scheme, AK is used to define waste streams or bound some waste characteristics and as a preliminary indication of what radionuclides might be present in the waste; qualitative measurements using NDA and other techniques (for other components) are made for 100% of containers. At lower levels of radioactivity, however, the quality of AK information assumes greater importance because---as described in your policies---it is used to distinguish between radionuclides that are absent or that could be present but in insufficient quantities to be detected by NDA equipment.

Specifically, AK information determines how an isotope's activity is reported if it is not detected above the LLD. Your policy describes the use of AK as follows:

- For the 10 specific isotopes tracked per the CH-WAC, one of three values is entered in the WWIS.
  - The measured value is entered if the isotope was present above its LLD.
  - If the isotope was expected per the Acceptable Knowledge Summary Report but not measured above its LLD, a value of "-1" is entered. This causes the WWIS to display the character string "<LLD".
  - If the isotope was not expected per the Acceptable Knowledge Summary Report and is not measured above its LLD, a value of zero is entered into WWIS.
- For the TRU alpha activity concentration, one of two values is entered. A calculated value (TRU activity divided by the waste mass) is entered if the TRU alpha activity within the waste container exceeded the instrument LLD. WWIS

then uses this value when determining the TRU alpha activity concentration for the payload container. If the TRU alpha activity within the container did not exceed the instrument LLD, WWIS uses a value of zero for this container when determining the TRU alpha activity concentration for the payload.

- Standard operating procedures are used to implement this policy and specify how data from the NDA batch reports are reviewed and entered into the WWIS. The relevant procedures are CCP-TP-030, *CCP TRU Waste Certification and WWIS Data Entry* and CCP-TP-086, *CCP TRUPACT-II Shipping Payload Assembly*, and you have transmitted current revisions of these procedures to EPA.

We have determined that these procedures outline an appropriate approach for tracking information when the LLD is appropriately determined. Specifically, it is appropriate to use a value of zero for TRU alpha activity to calculate the average TDOP activity if measured values do not exceed the instrument LLD. However, for the purpose of tracking radionuclide inventory in the WWIS, there is not justification for entering the LLD or any other numerical value, and doing so could introduce an unknown bias. Therefore, use of a character string such as "<LLD" is appropriate.

Documentation of AK must clearly state if waste streams may include waste below 100 nCi/g and must describe the volume of these wastes, waste generating processes, and waste management strategies. All waste stream AK summaries must include the above information and AK procedures must mandate the identification and inclusion of such information (including related to containers <100 nCi/g) if these wastes are to be used in load management. Based on inspections at SRS-CCP and ANL-CCP, we have found the AK acceptable as a component of waste characterization for certain types of waste. (See the applicable inspection reports, including Enclosure 3 for our March 2003 inspection of the SRS-CCP.) At SRS-CCP in particular, additional review confirmed that procedures have been modified to address the information described above. In future inspections where DOE is pursuing a load management strategy and overpacking, we will devote particular attention to confirming that AK information achieves a consistent level of detail for all containers in a waste stream, including those that may not meet the 100 nCi/g TRU alpha activity threshold.

Non-Destructive Assay

Non-destructive assay (NDA) systems are technically adequate for identifying and quantifying radionuclide content of waste drums for disposal at WIPP only when the measured activities of individual radionuclides and quantities derived from measured radionuclide activities (1) exceed the minimum detectable activity (MDA) and (2) are within the calibration and approved performance ranges of the instrument. For this purpose, the MDA is essentially analogous to the LLD and can vary depending on the waste matrix and resulting density, on background levels of radiation, and on other factors.

If the MDA for individual radionuclides is calculated for individual assay measurements (i.e., if it is adjusted to account for background radiation and the waste matrix of the individual drum), then any reported activities must exceed the reported

MDA (otherwise a character string indicating <LLD should be reported). If the MDA is not calculated for individual assay measurements, then the use of measurements based on surrogate waste containers would need to be fully justified and subject to EPA approval. Any measurements falling below the MDA would be reported with a character string so as not to introduce unnecessary bias in the measurements. Furthermore, MDA levels would not be valid if they fall outside the calibrated range of the instrument; extrapolation of the calibration range to cover MDA would be a potential concern depending on the methodology and underlying data, and also must be approved by EPA.

When no transuranic isotopes are detected at quantities above the MDA, the presence of TRU radionuclides in the container cannot be ascertained with a reasonable degree of confidence and an unbiased estimate of the TRU activity cannot be made. In this instance, the waste cannot be said to be radioactive based on the measurements alone (and cannot be said to confirm AK that suggests certain radionuclides may be present). Such waste should not be included in any TDOP disposed at WIPP. Thus, as stated in your policy, "Waste containers that show no indication of transuranic elements are rejected from the waste stream and returned to the host site for disposal elsewhere."

Waste Characterization at SRS-CCP and ANL-E

We have examined the use of AK and NDA by the SRS-CCP in particular, given that SRS has already been implementing the practice of measuring drums below 100 nCi/g and using the resulting values to calculate an average TRU waste activity for drums in a TDOP configuration. The use of AK is described in procedures provided to EPA and conforms to the description provided in your load management policy. As described above, we find this approach to be adequate. For NDA, the two systems being used by SRS-CCP are the IPAN-GEA and the IQ3. These were examined in detail to assess the validity of the LLD development, the calibrated range of the instrument, and the implementation of these limits in practice.

For the IQ3 system, the MDA for individual radionuclides and the minimum detectable concentration (MDC) are calculated directly by the GWAS system software for each measurement. Activities of individual radionuclides measured on the IQ3, and quantities derived from these measured activities, should be reported and used in further calculations only when the measured activity is greater than the MDA (or LLD) calculated by the GWAS software. (The exception is discussed above—the use of a value of zero in calculating the TRU alpha activity of a drum, provided that at least one transuranic isotope is detected above its MDA.) The MDA and minimum detectable concentration for a drum containing combustible waste and weighing 54.4 kilograms measured on the IQ3 were estimated to be 3.1 milligrams (mg) of plutonium-239 and 3.6 nCi/g, respectively.

The efficiency of the IQ3 as a function of gamma-ray energy was determined using a series of americium-241 and europium-152 calibration sources. This calibration is applicable to the full operating range of the instrument, defined as 0-1 gram plutonium-238 and 0-15 grams plutonium-239.

Thus, for the IQ3, we have confirmed that the MDA was established appropriately, that it is calculated for individual measurements, and that it falls within the calibrated range of the instrument. In combination with AK, therefore, it is approved for use over its full operating range. Values below the MDA should be reported in the WWIS as "<LLD". Drums in which no transuranic elements are detected above the MDA shall not be sent for disposal at WIPP. Further information on the IQ3, including the results of our inspection earlier this year, are provided in Enclosure 3.

For the IPAN-GEA at either SRS-CCP or ANL-E-CCP, we were not able to reach a similar conclusion. Our previous approvals of the IPAN-GEA were based on the assumption that it would be used only to quantify waste exceeding the 100 nCi/g threshold. Upon examination, we do not believe that it can be applied appropriately at levels below that threshold. The MDA varies over a significant range and is based on only three points deemed representative of a variety of waste streams. In practice, there is little confirmation that the applied MDA matches the waste matrix and density characteristics of the waste actually measured; there is no drum-by-drum adjustment as with IQ3. For these reasons, the use of IPAN at SRS-CCP and ANL-E-CCP to quantify radionuclides is restricted to drums exceeding the 100 nCi/g threshold. Drums not exceeding the threshold should be segregated for re-assay using a different system or for disposal in a facility other than WIPP.

Department of Energy
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04 AUG 2003

Mr. Frank Marcinowski, Director
Office of Radiation and Indoor Air
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Subject: National Transuranic Waste Program Policy and Implementation Method for Management of Alpha Activity Concentration within Transuranic Waste Streams

Dear Mr. Marcinowski:

Please find enclosed a copy of the paper entitled *Management of TRU Alpha Activity Concentration*.

If you have any questions, please contact me at (505) 234-7300.

Sincerely,

Chuan-Fu Wu for

Dr. Inés R. Triay
Manager

Enclosure

cc: w/enclosure
K. Watson, CBFO
B. Forinash, EPA
S. White, EPA
CBFO M&RC

CBFO:NTP:KWW:VW:03-2662:UFC:5822

Management of TRU Alpha Activity Concentration

Executive Summary

This document describes the National Transuranic (TRU) Waste Program (NTP) policy and the implementation method concerning the management of TRU alpha activity concentration in defense-generated transuranic waste destined for disposal at the U.S. Department Energy's Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico. As indicated in the document, management of TRU alpha activity concentration is: (1) based on policy rooted in federal law; (2) implemented through comprehensive waste acceptance criteria approved by the U.S. Environmental Protection Agency (EPA); and (3) audited and inspected for compliance by oversight and regulatory organizations.

Background

The U.S. Department of Energy's (DOE) NTP is responsible for the safe cleanup and disposal of our nation's defense-generated TRU waste. This program involves: (1) the characterization of waste at generator/storage sites located across the country; (2) shipment of waste that meets disposal requirements to the WIPP located near Carlsbad, New Mexico; and (3) disposal of the waste at WIPP in rooms located nearly one-half mile underground in ancient salt beds.

The *Waste Isolation Pilot Plant Land Withdrawal Act* (LWA), Public Law 102-579, established requirements for the disposal of TRU waste at WIPP and defined EPA responsibilities for regulating DOE activities at WIPP. The LWA defines TRU waste as:

> . . . waste containing more than 100 nanocuries of alpha emitting transuranic isotopes per gram of waste, with half lives greater than 20 years . . . (Sec.2 (r))

Policy

The NTP has established an internal policy to manage TRU alpha activity concentration in compliance with the LWA:

- The limit for TRU waste defined in the LWA (greater than 100 nCi/g) applies to the TRU waste stream as a whole. The National TRU Program complies with the limit established in the LWA by ensuring that each payload container disposed at WIPP is greater than 100 nCi/g.

- Section 3.3.3 of the EPA-approved *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 1, (CH-WAC) describes the method for calculating the TRU alpha activity concentration for a payload container.

- If the measured TRU alpha activity for individual waste containers within a payload container is above the Lower Limit of Detection (LLD), the actual measurement is used to calculate the activity concentration in the payload container; otherwise, a value of zero is assumed for the individual waste container. This approach is consistent with Section 3.3.1 of the EPA-approved CH-WAC.

Implementation and Practice

While this policy is available to all generator sites, the need to overpack waste containers to address TRU alpha activity concentration issues has only occurred to date at the Savannah River Site (SRS) and Argonne National Laboratory-East (ANL-E). At both sites, the NTP Central Characterization Project (CCP) is responsible for characterization and certification of the waste.

The CCP uses standard operating procedures to implement this policy. These procedures provide step-by-step requirements for measuring and calculating the TRU alpha activity concentration, and specify a comprehensive, well-defined paper trail that describes how the data from nondestructive assay (NDA) batch data reports are reviewed and entered into the WIPP Waste Information System (WWIS) database. Below is a summary of the process:

- An Acceptable Knowledge Summary Report is prepared for the transuranic waste stream that identifies all of the individual waste containers generated by the process or activity.

- The individual waste containers are assayed.

- Generation level and Project Office level reviews are performed on the data to ensure compliance with all Data Quality Objectives. In NDA, this includes review of system performance checks, Total Measurement Uncertainty (TMU) values, and reported isotopes. Also, the individual containers are grouped into three categories:
  - Those that have TRU alpha activity concentrations above 100 nCi/g
  - Those that assay less than 100 nCi/g yet exceed the LLD for the instrument
  - Those that assay below the LLD for the instrument.

- Data reconciliation activities are completed to compare characterization results with acceptable knowledge information. Any waste containers that show no indication of transuranic elements are rejected from the waste stream and returned to the host site for disposal elsewhere.

- Each waste container is certified by the Waste Certification Official (WCO) and the container data is entered into WWIS. Any container that does not individually meet the 100 nCi/g level is designated "to be overpacked" in the WWIS. For NDA, the data entered involves both the activity of each individual isotope, and the TRU alpha activity concentration for the waste container.

  For the 10 specific isotopes tracked per the CH-WAC, one of three values is entered. The measured value is entered if the isotope was present above its LLD. If the isotope was expected per the Acceptable Knowledge Summary Report but not measured above its LLD, a value of "-1" is entered (this causes the WWIS to display the character string "<LLD"). If the isotope was not expected per the Acceptable Knowledge Summary Report and not measured above its LLD, a value of zero is entered into WWIS.

  For the TRU alpha activity concentration, one of two values is entered. A calculated value (TRU alpha activity divided by the waste mass) is entered if the TRU alpha activity within the waste container exceeded the instrument LLD. WWIS then uses this value when determining the TRU alpha activity concentration for the payload container. If the TRU alpha activity within the waste container did not exceed the

instrument LLD, a negative instrument LLD value is entered into WWIS. WWIS then uses a value of zero for this container when determining the TRU alpha activity concentration for the payload. Using this approach, the TRU alpha activity concentration for an overpacked payload container is conservatively calculated.

- The WCO then selects individual waste containers to be overpacked into a larger payload container.
- The containers identified by the WCO are overpacked into payload containers.
- The Transportation Certification Official (TCO) selects payload containers from the available payload containers within the WWIS and assembles the payload that will go in the shipping container.
- The WIPP WWIS Data Administrator reviews and approves the payload for shipment to the WIPP.
- The TCO completes the shipment documentation and the shipment is released for transport to the WIPP.

In practice, this policy allows TRU waste generator/storage sites to overpack individual TRU waste containers that assay less than 100 nCi/g into larger payload containers such as a ten-drum overpacks (TDOPs) to ensure that the TRU alpha activity concentrations of all payload containers shipped to WIPP are greater than 100 nCi/g.

It is important to reiterate the following controls:

1. Only containers from a transuranic waste stream are acceptable for this overpacking. This means each waste container must meet two criteria to be eligible for overpacking. First, it must be part of the transuranic waste stream as defined in the acceptable knowledge summary report for that waste stream. Second, NDA must confirm the presence of transuranic elements within the waste container.
2. The TRU alpha activity concentration for the overpacked payload container is conservatively calculated.
3. The limit checks in WWIS ensure that the TRU alpha activity concentration is at least 100 nCi/g in each payload container accepted for disposal at the WIPP.

As of July 1, 2003, approximately 326, or less than 1% of all payload containers emplaced in the WIPP underground have been overpacked to address TRU alpha activity concentration issues. It is important to note that TRU waste containers are overpacked for other reasons, including fissile gram equivalent limits, decay heat limits (wattage), weight limits, and container integrity.

Oversight

Compliance with the TRU alpha activity concentration management requirements of the LWA, CH-WAC, internal policy, and standard operating procedures is evaluated through TRU waste characterization program audits performed by the Carlsbad Field Office (CBFO). The EPA approved CH-WAC describes how TRU alpha activity concentrations will be determined for overpacked containers. The EPA also performs inspections of waste characterization activities at the generator sites as required by 40 CFR 194.8 and §194.24.

The EPA inspects site waste characterization programs during initial site certification. These inspections are normally performed concurrently with the CBFO audit of the generator site. These inspections include the NDA systems that the generator site plans to use for waste characterization. As documented in EPA's inspection reports, EPA verifies that system calibrations have been performed as required, the TMU has been determined, and that the LLDs for the NDA system have been determined.

The EPA has inspected the waste characterization programs of SRS and ANL-E., the only two sites that have overpacked waste containers to address TRU alpha activity concentration issues. The EPA's February 5, 2002 inspection report of the CCP program at SRS (EPA-CCP-10.01-8) included a review of the transuranic LLD[1] for the IPAN/GEA. As documented in the EPA checklist attached to the inspection report (page 69), the transuranic LLD for the IPAN/GEA varies from 18 to 40 nCi/g. As the EPA checklist states, this conclusion is based on the review of *BII Mobile Assay System Quality Assurance Objective Compliance, BII-5104-QAO-001, Rev. 2.* This document was reviewed in detail during the inspection/audit by both the CBFO auditors and the EPA inspectors. This conclusion concerning the LLD of the instrument is also in the body of the inspection report (pg 48), *"The minimum detectable concentration (MDC) was shown to be between 18 nCi/g and 40 nCi/g for the active mode, depending on the absorption and moderating powers of the waste matrix, based on standard deviations estimated from replicate measurements."*

In its December 9, 2002 inspection report for the CCP program at ANL-E (EPA-ANL-E-CCP-09.02-8), the EPA verified that the LLD for the APNEA NDA system had been determined. This was based on the review of *APNEA LLD/MDC Empirical Measurements Results, Rev. 3.* This document was also reviewed by both the CBFO auditors and the EPA inspectors during the audit/inspection. The LLD for the APNEA in the active mode was 47 nCi/g as documented in the EPA inspection checklist (page APNEA-3).

During the EPA inspection at SRS on March 25 – 27, 2003, the transuranic LLD for the IQ3 system was reviewed by both CBFO auditors and the EPA inspectors. The transuranic LLD for the IQ3 system is as low as 3 nCi/g depending on the waste matrix. This was based on a review of *Calibration and Validation Report for the MCS IQ3 at the Savannah River Site, Rev. 1, 3/14/03, MCS-SRS-NDA-0203.*

The CBFO audits and EPA inspections for the NDA equipment at SRS and ANL-E were performed using checklists that were developed from the applicable regulations and implementing procedures. EPA randomly selected previously assayed containers to be re-assayed on each piece of equipment. The re-assays were witnessed by EPA and CBFO auditors, and the documented re-assay results were evaluated by EPA consultant staff.

The documents that were reviewed by the EPA inspectors and the CBFO auditors are the technical basis for the establishment of the LLD for these instruments. The witnessing of satisfactory performance of the equipment and the review of associated documentation were the justification for the audit team's conclusion that the NDA processes for the SRS and ANL-E equipment were satisfactory implemented and effective.

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[1] In a strict sense, the LLD is an isotope-specific parameter. It is measurement based and incorporates predetermined levels of uncertainty, reported at the 95 % confidence level. Values obtained above the LLD on a given assay system are valid measurements. For this paper we use the term Transuranic LLD, meaning the lower end of range of the assay system's ability to identify and quantify transuranic isotopes in a waste container. This is based on the system's ability to provide technically defensible measurements of all TRU isotopes within the waste container. As discussed in this report, the three assay systems in question have demonstrated transuranic LLDs in the range of 3 – 47 nCi/g. In the previous version of the WAC, the term minimum detectable concentration (MDC) was used instead of LLD. In this context the terms are equivalent.

Summary

NTP management of TRU alpha activity concentration is based on policy rooted in federal law and implemented through comprehensive waste acceptance criteria approved by the U.S. Environmental Protection Agency. The practice of overpacking individual TRU waste containers that assay less than 100 nCi/g into larger payload containers is consistent with LWA and the CH-WAC. This practice is implemented through standard operating procedures and compliance with the requirements is verified during initial and annual site audits. The EPA also verifies compliance with the requirements for waste characterization during inspections of the waste characterization programs at the generator sites and by CBFO during audits.

DOCKET NO: A-98-49, Item II-A4-32

WASTE CHARACTERIZATION INSPECTION REPORT

EPA INSPECTION No. EPA-SRS-CCP-03.03-8

of the

CENTRAL CHARACTERIZATION PROGRAM AS IMPLEMENTED AT THE SAVANNAH RIVER SITE

March 25-27, 2003

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Radiation and Indoor Air
Center for Federal Regulations
1200 Pennsylvania Ave., NW
Washington, DC 20460

June 2003

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Attachments

1.0 EXECUTIVE SUMMARY

In accordance with 40 CFR 194.8(b), on March 25-27, 2003, the U.S. Environmental Protection Agency (EPA or we) conducted EPA Inspection No. EPA-SRS-CCP-03.03-8 for the Central Characterization Program (CCP) as implemented at the Savannah River Site (SRS) located in South Carolina. The purpose of the inspection was to determine the adequacy of the CCP SRS Waste Characterization (WC) system for characterization of transuranic (TRU) debris waste (Waste Category S5000) using nondestructive radioassay (NDA) and Acceptable Knowledge (AK). The Department of Energy (DOE) currently has an EPA approval of the CCP program implemented at SRS for analyzing Contact-Handled (CH) retrievably- stored debris waste (Waste Category S5000) however the NDA system inspected was not included in that approval.

We must verify compliance with 40 CFR 194.24 before waste may be disposed of at the WIPP, as specified in Condition 3 of the Agency's certification of the WIPP's compliance with disposal regulations for TRU radioactive waste (63 FR 27354, 27405; May 18, 1998). The waste characterization systems and processes that EPA inspected were for a group of waste streams that are collectively categorized as retrievably stored, contact-handled (CH) TRU debris wastes (S5000) generated at SRS near Aikin, South Carolina. The EPA's inspection focused on the NDA using a new IQ3 system and the continued adequacy of the acceptable knowledge (AK) examination processes.

Based on the inspection results, EPA has determined that the CCP SRS can adequately characterize contact-handled (CH) retrievably stored debris waste generated at SRS with respect to Acceptable Knowledge and non-destructive assay using the inspected IQ3 system. Non-destructive examination (RTR), visual examination, and data transfer using the WIPP Waste Information System (WWIS) were not re-examined, but had been inspected and approved at EPA inspection EPA-CCP-10.01-8.

EPA identified no findings and four (4) concerns. Of the concerns, three (3) require a response from DOE. On May 28th EPA received objective evidence from DOE which responded to the issues presented in 3 of the 4 EPA concerns. As a result only one concern remains to be addressed by DOE. While a DOE response is still required for the remaining open concern, EPA has found the implementation of the IQ3 system and the AK process to be adequate to characterize contact-handled (CH) TRU debris waste (S5000).

2.0 PURPOSE OF INSPECTION

On May 18, 1998, EPA certified that the WIPP will comply with the radioactive waste disposal regulations at 40 CFR 191 (63 Fed. Reg. 27354). EPA's certification of the WIPP contains the following condition (Condition 3): "The Secretary shall not allow shipment of any waste from any additional [Los Alamos National Laboratories (LANL)] waste stream(s) or from any waste generator site other than LANL for disposal at the WIPP until the Agency has approved the processes for characterizing those waste streams

for shipment using the process set forth in § 194.8." In accordance with § 194.8(b)(2), EPA must inspect waste characterization systems and processes used by Department of Energy (DOE or Department) transuranic waste sites before approving those sites to ship TRU waste to the WIPP.

The approval process described at 40 CFR 194.8 requires the Department to provide EPA with two types of information: (1) information on process knowledge[1] for waste streams proposed for disposal at WIPP, and (2) information on the system of controls in place at the generator site that is used to confirm that the total amount of each waste component that will be emplaced in the WIPP will not exceed limits identified in the WIPP Compliance Certification Application (CCA). After reviewing these materials, an EPA inspection/surveillance team visits the site to verify that process knowledge and other elements of the system of controls (namely, nondestructive assay, visual examination, real-time radiography, and WIPP Waste Information System) are technically adequate and being implemented properly. Specifically, the EPA inspection/surveillance team verifies compliance with 40 CFR 194.24(c) (4), which states:

> *** Any compliance application shall: *** Provide information which demonstrates that a system of controls has been and will continue to be implemented to confirm that the total amount of each waste component that will be emplaced in the disposal system will not exceed the upper limiting value or fall below the lower limiting value described in the introductory text of paragraph (c) of this section.[2] The system of controls shall include, but shall not be limited to: measurement; sampling; chain of custody records; record keeping systems; waste loading schemes used; and other documentation.

In other words, the purpose of inspection is to verify that DOE waste generator sites, which characterize TRU waste prior to shipment to the WIPP, are characterizing and tracking the waste in such a manner that EPA is confident that the waste will not exceed the approved limits. By approving waste characterization systems and processes at SRS, EPA certifies that those systems and processes can accomplish two tasks: (1) they can identify and measure the waste components (such as plutonium) that must be tracked for

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[1] Process knowledge refers to knowledge of waste characteristics derived from information on the materials or processes used to generate the waste. This information may include administrative, procurement, and quality control documentation associated with the generating process, or past sampling and analytic data. Usually, the major elements of process knowledge include information about the process used to generate the waste, material inputs to the process, and the time period during which the waste was generated. In the context of these reports specifically and waste characterization generally, EPA uses the term "acceptable knowledge" synonymously with "process knowledge."

[2] The introductory text of paragraph 40 CFR 194.24(c) states: "For each waste component identified and assessed pursuant to [40 CFR 194.24(b)], the Department shall specify the limiting value (expressed as an upper or lower limit of mass, volume, curies, concentration, etc.), and the associated uncertainty (i.e., margin of error) for each limiting value, of the total inventory of such waste proposed for disposal in the disposal system."

compliance[3]; and (2) they can confirm that the waste destined for the disposal at the WIPP has been properly identified as belonging to the group of approved waste streams. Under 40 CFR 194.24(h), EPA may perform follow-up surveillance to verify that a TRU waste site is shipping waste that belongs only to those waste streams or groups of waste streams that have been characterized by the approved processes.

3.0 PURPOSE OF THIS REPORT

This waste characterization inspection report documents the basis for EPA's decision by explaining the results of Inspection No. EPA-SRS-CCP-03.03-8 in terms of findings or concerns. The report, if applicable, provides objective evidence of outstanding findings (nonconformances) in the form of documentation. The report also describes any tests or demonstrations completed during the course of the inspection. The completed checklists attached to the report show the documents (principally procedures) that the EPA inspection team reviewed. If you wish to see any items identified in the attached checklists, please contact:

Quality Assurance Manager
USDOE/Carlsbad Field Office
P.O. Box 3090
Carlsbad, NM 88221

EPA's decision to approve or disapprove the system of controls (processes) used to characterize one or more waste streams at a site is conveyed to DOE separately by letter, in accordance with 40 CFR 194.8(b)(3). This report identifies and explains the basis for EPA's decision as contained in the letter. EPA's approval or disapproval extends only to the processes reviewed during the inspection and identified in this report and its attachments. Only waste that can be adequately characterized using processes verified by EPA through inspection or surveillance may be shipped to the WIPP for disposal.

4.0 SCOPE

The scope of Inspection No. EPA-SRS-CCP-03.03-8 incorporated the technical adequacy of the system of controls used to characterize waste material parameters

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[3] The potential contents of a waste stream or group of waste streams determine which processes can adequately characterize the waste. For example, if acceptable knowledge information suggests that the waste form is heterogeneous, the site should select a nondestructive assay technique that suits such waste in order for adequate measurements to be obtained. Radiography and visual examination help both to confirm and quantify waste components such as cellulosics, rubbers, plastics, and metals. Once the nature of the waste has been confirmed, the assay techniques then quantify the radioactive isotopes in the waste. In the given example, a TRU waste site may be able to characterize a wide range of heterogeneous waste streams or only a few. EPA's surveillance scope is governed by a site's stated limits on the applicability of proposed waste characterization processes.

(WMPs) and the ten WIPP-tracked radionuclides (^{241}Am, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{90}Sr, ^{233}U, ^{234}U, and ^{238}U), with an emphasis on nondestructive assay (NDA) and acceptable knowledge (AK).

EPA inspection EPA SRS-CCP-03.03-8 was performed to: 1) evaluate continued compliance of the approved AK process with respect to characterizing debris waste, and 2) assess the viability of a new radioassay system, IQ3, for characterizing debris waste. The EPA inspectors did not re-examine radiography, visual examination, data validation/verification (outside of that examined during system review) or the WIPP Waste Information System (WWIS).

5.0 DEFINITIONS

Finding: A determination that a specific item or activity does not comply with 40 CFR 194.24(c) (4). A finding requires a response from CBFO.

Concern: A judgment that a specific item or activity may or may not have a negative effect on compliance and, depending on the magnitude of the issue, may or may not require a response.

6.0 INSPECTION TEAM

The members of the EPA waste characterization surveillance team are identified below.

Surveillance Team Member	Position	Affiliation
Mr. Ed Feltcorn	Inspection Team Leader	EPA
Ms. Connie Walker	Inspector	EPA Support Contractor
Dr. David Stuenkel	Inspector	EPA Support Contractor
Observer		
Mr. Scott Webb	Observer	EEG

Numerous DOE Carlsbad Field Office (CBFO) and CCP personnel, including both DOE staff and support contractors, participated in EPA's inspection. The CBFO conducted a technical quality assurance audit of SRS's CCP CH TRU waste characterization using the IQ3 concurrent with EPA's inspection. The CBFO audit was supported by the Carlsbad Technical Assistance Contractor (CTAC). Mr. Steve Davis, a CTAC employee, served as the CBFO Audit Team Leader and was DOE's primary point of contact with the EPA inspection team. The CCP is a Los Alamos TRU waste

characterization program that is contracted by DOE facilities to perform waste characterization activities. SRS awarded a contract to the CCP to perform non-destructive assay, and acceptable knowledge, radiography, visual examination, and data management/transfer (eQA) activities for TRU waste destined to WIPP.

The Savannah River Site is located in South Carolina on approximately 310 square miles. It is bounded on the southwest by the Savannah River and occupies parts of Aiken, Barnwell, and Allendale counties. SRS has approximately 2900 cubic meters of CH-TRU waste in storage.

The purpose of this inspection was to determine the acceptability of the CCP characterization systems for characterizing retrievably stored contact handled transuranic (TRU) debris waste. Newly generated TRU waste was not assessed during the audit.

7.0 PERFORMANCE OF THE INSPECTION

EPA Inspection No. EPA-SRS-CCP-03.03-8 of the SRS site took place March 25-27, 2003. The inspection focused on the non-destructive assay (NDA) and acceptable knowledge (AK) elements of the SRS program. These elements are included in the "system of controls" for waste characterization that is identified in 40 CFR 194.24(c)(4). The inspection was conducted in the following steps:

1) Preparation of draft checklists prior to the inspection based upon CCA documents

2) Review of site procedures and other information, and modification of EPA checklists, if necessary, to incorporate site-specific information

3) On-site verification of the technical adequacy or qualifications of personnel, procedures, and equipment by means of interviews, demonstrations, and completion of checklists.

The following subsections address each technical area in turn. Each subsection identifies, as appropriate, key documents that the EPA surveillance team reviewed, key site personnel who were interviewed, key demonstrations that were performed, and any findings or concerns. The checklists attached to this report (Attachments A.1 - A.2) reveal in greater detail the scope of EPA's inquiries and the specific items and activities reviewed.

7.1 Acceptable Knowledge (AK)

AK is used to help determine the following aspects of TRU wastes at SRS:

- General waste material parameter content of waste;
- Radionuclide content of waste with respect to identifiable isotopic ratios of the EPA 10 radionuclides and other radionuclides;
- Buildings in which wastes were generated;

- Waste stream determination; and
- Defense waste status.

EPA's Inspection EPA- SRS-CCP-03.03-8 was performed to evaluate continued compliance of the program for characterizing retrievably stored debris waste (S5000). To accomplish this, several technical elements were assessed. The checklist at Attachment A.1 includes objective evidence examined to assess these elements.

- Overall procedural technical sufficiency and scope, with emphasis on tracking of the AK waste characterization process for individual containers and waste streams
- Characterization of waste material parameters and radionuclides as required by 40 CFR 194.24, the revised CH-WAC, and attachments to the CCA
- Compilation of AK information and use of supplemental information
- Confirmation of AK and resolution of discrepancies
- Technical adequacy of AK characterization results
- Preparation of the AK summary
- Technical adequacy of required procedures (e.g., a consistent definition of waste streams)
- Reassignment of any waste based on an analysis of AK and discrepancies
- Appropriate determination of AK accuracy

The following documents were among those examined to assess these issues, and include those evaluated to determine whether AK data assembly, compilation, confirmation, and accuracy assessments were being adequately performed:

- DR004, RCRA F-Listed Pre-1990 Debris , Discrepancy Resolution and CCP-TP-005, Attachment 13, Acceptable Knowledge Source Document Discrepancy Resolution Waste Stream SR-W027-221H-HET Tracking Form

- CCP-TP-005, Revision 11, CCP *Acceptable Knowledge Documentation*

- CCP-TP-005, Revision 11, Attachment 4, *Acceptable Knowledge Source Document Reference List for Waste Stream SR-W027-221H-HET*

- D056, *Safety Analysis-200 Area; Savannah River Plant, Separations Area Operations, Building 221-H, B-Line, Plutonium Oxide Facility* (Sup 2c), July, 1991

- M079, Accountability Book, Pu Oxide II, SR0IC-50, 1980-1984

- C154 Record of Communication, Radiological Data for HB Line, Interview with Steve Mentrup dated 2/7/03

- DR010, Radiological Distribution Data-GoWest Database verses Burial Ground Records, Discrepancy Resolution, 3/22/03

- CCP-QP-005, Revision 7, *CCP TRU Noncomforming Item Reporting and Control,* 10/24/2002

- P057, DPSOP 40, Various Revision, 1970-80s, Dupont De Nemours Company, Atomic Energy Division, various hazards bulletins.

- Acceptable Knowledge Accuracy Report, Savannah River Site (SRS) Waste Stream Number SR-W027-FB-Pre86C, Combustible Organic Debris Waste, Lots 1-14, March 25, 2003

- D006, *Technical Manual—Plutonium 238 Scrap Recovery, Building 221-H*, June 1, 1975

- D034, *Transuranic Waste Baseline Inventory Report*, Revision 2, December, 1995

- D052, *200 Area Savannah River Plant HB-Line Operations*, DPSTSY-200-11, May 1978, E.I Du Pont De Nemours and Company

- M011, GoWest Database Querry, December 13, 2002

- M014, Burial Ground Records and TRU Waste Package Data Forms, various dates.

- Radioassay Data Sheets, Containers SR164760 (R0-R5), ST176807(R0-R5), ST526246, dated 3/18/03

- C009, Meeting Minutes, Determination of Isotopes and Quantities Present in TRU Boxed Waste, May 31, 1989

- C026, Memo from R.C. Hochel, Recommendations and Final Report for TRU Boxed Waste Measurements Task Team, October 13, 1989

- C040, Memo from C.H. Ashford to F.E. Lustig, Project S-2991, Transuranic (TRU) Waste Facility Waste Characterization and Burial Container Criticality Limits, January 23, 1990.

- C045, Letter from J.L Forstner, Nuclear Safety Limits for Various Isotopes in the Burial Ground Record, June 14, 1974

- C126, Memo from J.M.Gibson, Old HB-Line Procedures, NMP-SCH-93-1093, October 19, 1993

- C135, Memo to D.H. Thomas from T.M.Thompson, Disposal Methods for Pu-238 Frame 1, May, 1985

- CCP-AK-SRS-4, Rev. 1 *Appendix A1, Complete References and Source Document*

Listings, 3/21/03

- D050, *Characterization of the HB-Line Low-Level Waste*, T.Baldwin, WSRC-TR-94-0371, Revision 4, June, 1998, Westinghouse Savannah River Company
- *Quality Assurance Audit I02-07 Audit Report, Central Characterization Program Quality Assurance Program*, September 3, 2002
- Central Characterization Project Weekly Report Ending 3-23-03
- CCP-TP-066, Revision 0, CCP *Radiography Screening Procedure for Prohibited Items*, 3/9/02
- List of Containers with Prohibited Items Noted, Memo from J. Melton to J.Whitworth, March 25, 2003
- COBRA database container printouts, for Containers SR164760, SR526246, and SR176807
- Nonconformance Report NCR-SRS-0303-03; impenetrable material obscuring RTR viewing of batch SRRTR0460 contents, March 19, 2003
- Batch Data Reports, RTR, SRRTR0429, SRRTR0428, SRRT0444
- Acceptable Knowledge Expert Qualification Cards for Anne Hallman and Julia Whitworth
- Acceptable Knowledge Accuracy Report: Savannah River Site (SRS) Waste Stream Nubmer SR-W027-221F-Het-A, Heterogeneous Debris Waste Lots 1-19, March 24, 2003
- Waste Stream Profile Form Package for SR-W027-FB-Pre86-C, Revision 1, October 28, 2002
- Pre-86 SpreadSheet Print out, WMP tabulation on containers, running totals to show that overall waste stream within the WMC assigned, March 25, 2003
- C028, Memo to S.A. Yano, Estimation of PU Isotopic in Waste from 221-H, Room 306, December 20, 1989
- Burial Ground Records for Containers SR164760, SR526246, and SR176807
- CCP-TP-005, Rev. 11, *Attachment 1, SRS, Pre 90 Hazardous Debris Waste SR-W027-221H-HET*, February 5, 2003

- CCP-TP-005, Rev 11, Attachments 6 and 7, SRS CCP-AK-SRS-4, SR W-27-221H-HET

- CCP-TP-005, Rev 10, Attachments 10, 11, 12, SR-W027-FB-Pre86-C Rev 1, 12/16/02

- CCP-AK-SRS-4, *Acceptable Knowledge Summary Report for Savannah River Site Waste Streams: SR-W027-221H-HET, SR-W026-221H-HET-A, SR-W026-221H-HET-B, ST-W027-221H-HEPA, SR-T001-221H-HEPA, SR-W027-HBL-Box*, March 21, 2003

- CCP-AK-SRS-1, *Central Characterization Project, Acceptable Knowledge Summary Report for Savannah River Site Waste Streams: SR027-221F0-HETA, HET-D-D, HET-E*, Revision 9, March 13, 2003

- CCP-AK-SRS-2, *Central Characterization Project Acceptable Knowledge Summary Report for Savannah River Site, SR-W027-FB-Pre86-C*, Rev 2, October 21, 2002

- CCP-AK-SRS-3, *Central Characterization Project Acceptable Knowledge Summary Report for Savannah River Site Waste Streams: SR-T001-221F-HET, SR-W026-221F-HET-A, ST-W026-221F-HET-B, ST-W-26-221F-HET-C, ST-W026-221F-HET-D, SR-W026-221F-HET-E, SR-T001-221F-HOM, SR-T001-221F-HEPA,* Revision 0, August 6, 2002

During the inspection, we assessed several technical elements of the SRS CCP's AK process (see Attachment A.1), including those discussed below.

1) The data assembly process was well documented, with good "roadmaps" to available data and exceptional documentation of data assembly-related activities. Data were traceable.

The CCP program had prepared four SRS AK Summary reports that document AK data for various waste streams (each report addressed between one and eight waste streams). Of these, the latest, CCP-AK-SRS-4, was examined in detail because it was the most recent report prepared and because EPA had selected containers from this waste grouping (specifically the HET waste stream) for replicate NDA testing. This document included both an overall AK reference list (Attachment 1), as well as individual waste stream-specific reference lists (Attachment 4) and AK Documentation checklists that link the mandatory facility and program information to specific references. These lists facilitated examination of the AK Summary Report by associating assembled information to specific AK requirements. In addition, these lists helped when the traceability analysis was performed. EPA had selected three containers for replicate NDA testing. These same containers were also used in the AK traceability analysis: SR164760, SR526246, and SR176807. COBRA database print outs, Burial Ground Records, and NDA/NDE (RTR) data were obtained for these containers to assess traceability of data from the unique AK records (Burial Ground Records), through the AK Summary, up to data confirmation

(batch data reports). It is important to note that EPA examination of Batch Data Reports is performed to assess AK traceability. It is not approval of the data with in the Batch Data Reports. EPA examines these reports only to see how data obtained through the confirmation process are presented and ultimately how this information is used in AK confirmation. Up to this point, we had elected to not examine full batch data reports for these containers; instead we examined data summary sheets for the selected containers to assess data traceability. We found that the data for these containers were traceable up to data acquisition for confirmation, although none of the WS 4 containers had yet been through the full AK confirmation process. AK confirmation was assessed for the Pre86C waste stream (presented in CCP-AK-SRS-2), and was found to be adequate with respect to TRU waste.

2) Data assembly was well done and well documented, and the CCP AK Summary Report was particularly well prepared with respect to data compilation for some TRU waste streams.

The AK Summaries in CCP-AK-SRS-4 for TRU waste streams HET and HET A were exceptionally detailed. For example, the HET waste stream AK Summary included all of the required information pertaining to area/building of generations, waste stream volumes, waste generating activities, etc., and documented the WMPs as an overall percentage of specific WMPs that are expected with respect to WMC assignment. With respect to radiological characterization, the CCP documented not only all processes that generated wastes, but AK-derived isotopic information down to the specific campaign level, as well as AK assay data that were generated, waste limits (with respect to radionuclides) that were imposed, and potential assay interferences (on a compound/element basis). Also, all required isotopes were identified and isotopic ratios were presented, as well as other radionuclides (i.e., ^{237} Np) that may have been present but were outside the "EPA 10" radionuclide group. As appropriate, reference data from the HB HET and HETA in yet-to-be completed AK summaries were evaluated to ensure that applicable AK data are included by reference. Also, if the SRS-4 AK Summary Document is ever "parted out" in the future into individual waste stream AK Summaries (as separate documents), the detail in one summary would have to be repeated in any summaries that reference the information to ensure the documents are "stand alone". The HB HET should also ensure that fission isotopes important to EPA (e.g., ^{137}Cs and ^{90}Sr) are addressed, and clarify why these isotopes were mentioned in supporting documentation but were determined to not to be significantly present in the HET waste. Also, NDA indicated that some containers have no detectable quantities of measured radionuclides. While the AK Summary discusses the possibility that assumptions were made with regard to radionuclide content (that could have been overly conservative), if possible, an estimate of the number of containers that AK indicates may have no measurable quantities should be included. If this estimate is not possible, a simple clarifying statement could be made. Note that EPA reviewed all AK Summaries for approval of TRU waste only; analogous data pertaining to LLW was assessed solely for applicability to the TRU stream, but approval of LLW AK was neither sought by CBFO nor granted by EPA.

3) The AK Summary Report addressed the assignment of waste matrix codes to TRU waste streams, adequately justified the assignment of waste matrix codes, and had revised waste matrix code assignments, as necessary.

The AK Summary Report CCP-AL-SRS-4 included a robust method of examining Burial Ground Records and other AK data to derive specific waste matrix codes. In addition, the CCP had to modify an AK-assigned waste matrix code determination for a waste stream. Specifically, CCP-AK-SRS-2 originally included two different TRU waste streams—SR-W027-FB-Pre86-C (combustible) and SR-W027-FB-Pre86-NC (noncombustible). During review of batch data reports, the CCP SPM discovered that most of the containers assigned to the noncombustible stream were actually comprised of combustible material; only 6 of the 257 containers identified as being noncombustible actually contained noncombustible materials in excess of 50% by volume. A re-evaluation form was issued in October of 2002, and the CCP recommended that the noncombustible waste containers be moved to the combustible waste stream. The CCP revised the AK Summary to combine the two TRU waste streams, but also retained language and documentation noting the original error, stating in part: "Finally, waste stream confirmation data collected during radiography activities demonstrated that segregation of noncombustibles was not well implemented, as the waste designated noncombustible by generators contained only approximately 6% by volume inorganic materials...contradicted what is known based solely on Burial Ground Records...." Additionally, the error was reported in the March, 2003 Accuracy Report for the Pre-86-C waste stream. The site "moved" all containers to the correct waste stream after 251 were found to have been incorrectly placed in the inorganic category, and the AK accuracy reflects this initial 251 misidentification, showing an 80.5% AK Accuracy. If the site had not identified the error until the entire noncombustible waste stream had undergone RTR, then the AK accuracy would have been much lower, but the site correctly identified the error and remedied the situation.

4) The AK Summary Report adequately addressed the processes by which TRU wastes were generated.

The AK Summary CCP-AK-SRS-4 included detailed discussion of the specific processes by which wastes were generated. The SRS HB waste included individual wastes from specific campaigns, and the CCP personnel provided time lines correlating wastes/activities to specific dates. The AK Summary included data for non-TRU waste; EPA evaluated this data in support of the TRU waste stream characterization, but EPA's AK assessment only addressed TRU waste. Also, CCP personnel indicated that individual bags of waste were sometimes assayed, and this assay information was assessed and included in the AK Summary. When asked whether the AK assay data could be correlated to specific drums, CCP representatives stated that AK data could be linked to specific bags of waste, but this waste was often commingled within larger 55 gallon drum containers, making correlation of drums to specific campaigns not possible.

5) SRS CCP employed a "Fast Scan/Quick Screen" method of examining containers using RTR; this data should be considered AK data and be integrated into the AK record.

CCP-TP-066 was a quick RTR method of examining containers to determine the presence of prohibited items, specifically liquids. SRS employed this method of data acquisition to screen out WIPP-non compliant containers before the drums were sent through the more extensive RTR scan. The use of the QuickScreen is a good way to gather supplemental AK information to augment determinations made through "paper" AK data assembly. These scans actually resulted in the removal of almost 400 containers from the characterization process due to the presence of prohibited items. The CCP AKE should ensure that all QuickScreen data are integrated into the AK record. DOE should also encourage these types of innovative activities to augment AK data.

6) The AK confirmation process could not be completely assessed for Waste Streams in CCP-AK-SRS-3 or 4, but could be assessed for waste presented in AK Summary CCP-AK-SRS-2.

The CCP had not performed the full confirmation process outlined in the AK procedure. AK Accuracy had not been performed for the waste streams presented in CCP-AK-SRS-3 and 4. However, SRS CCP personnel had confirmed the Pre-86C waste stream presented in CCP-AK-SRS-2, and an AK Accuracy report for this stream was also prepared.

7) The AK Accuracy Report satisfied CCP procedural requirements, but there were areas where improvements could be made.

Related to TRU AK Accuracy and with respect to the tracking of WMC outliers that could impact AK accuracy, SRS should consider more distinctly indicating those containers that are "outliers" (i.e., those that fall outside of the designated WMC or AK NDA isotopic/radionuclide distributions). While it is recognized that the occasional outlier may be present, if a consistent trend is indicated, the site should note this and perform the appropriate tasks to deal with the issue. Better tracking of outliers could facilitate this type of assessment. Also, the SRS did maintain a "running total" of WMC data on a waste stream basis, but SRS could best report this data by preparing the AK Accuracy Report on an annual or even more frequent basis, updated as lots are completed, rather than by preparing a separate AK Accuracy report for each lot grouping. Addressing both of these issues would likely be very helpful to ensure that the problematic wastes are quickly identified and dealt with if appropriate (i.e., reoccurrence of outliers could require reassessment), and to ensure that AK Accuracy for the waste stream is presented, as AK Accuracy on a lot grouping basis could present an incorrect understanding of the waste stream accuracy as a whole. The following should also be considered when preparing the AK Accuracy Report:

- At SRS, ^{242}Pu, ^{90}Sr, and ^{234}U in TRU waste are apparently determined by calculation and not by measurement. AK indicated that none of these are prevalent isotopes in the HET or HETA waste. If these isotopes are found to be present as major contributors to the isotopic mix (on a mass basis), the

SPM should make note of this and ensure that this is assessed as it could be necessary to re-evaluate the AK Summaries with respect to daughter products. It is assumed that each container shall be examined for consistency between NDA and AK, recognizing that outliers between NDA and AK do not mandate any actions per se, but that consistent problems should be highlighted and remedied, as necessary.

- CCP-TP-005 does not require a "write up" to accompany the AK Accuracy checklist, but experience has shown that an explanation of data is valuable, and would become even more so when the number of containers included in AK Accuracy Reports increases. The CCP Program may wish to standardize this write-up, and include this in CCP requirements. The discussion need not be extensive, but should summarize results of the AK Accuracy Calculations/assessments.

- Ensure that written text accurately and completely represents the data that are the source of the text. For example, the AK Accuracy Report for WS 2 (Pre86-C, FB line) says that several AK Confirmation Checklists show ^{241}Pu being present as an outlier. The Report should also state that the outliers are lower than the weight percent indicated by AK, and provide the measured values and AK ranges.

Findings:

The EPA inspection team identified no AK findings.

Concerns:

The EPA inspection team identified no AK concerns.

7.2 Nondestructive Assay (NDA)

As part of the inspection, EPA reviewed the elements of the NDA process listed below. The checklist at Attachment A.2 identifies the objective evidence that we examined.

- Capability of the measurement hardware and software to perform the required analyses,
- Technical adequacy of the assay program's documents and procedures, and
- Knowledge and understanding of the personnel involved in the NDA program.

The following documents were among those examined to assess whether NDA characterization was being adequately performed:

- CCP-PO-002, Revision 5, *CCP Transuranic Waste Certification Plan*, 02/12/03
- CCP-QP-012, Revision 12, *CCP Training and Qualification Plan*, 02/24/02
- CCP-QP-005, Revision 7, *CCP TRU Noncomforming Item Reporting and Control*, 02/24/02
- CCP-QP-008, Revision 8, *CCP Records Management*, 09/04/02
- CCP-TP-046, Revision 1, *CCP Mobile IQ3 System Calibration Procedures*, 03/21/03
- CCP-TP-047, Revision 1, *CCP Mobile IQ3 Gamma Scanner Operation*, 03/21/03
- CCP-TP-048, Revision 1, *CCP Mobile IQ3 System Data Reviewing, Validating and Reporting Procedure*, 03/21/03
- *Calibration and Validation Test Plan for the MCS IQ3 at the Savannah River Site*, Revision 0, Document No. MCS-SRS-NDA-1000, 11/07/02
- *Calibration and Validation Report for the MCS IQ3 at the Savannah River Site*, Revision 0, Document No. MCS-SRS-NDA-TMU-2003, 02/14/03
- *Total Measurement Uncertainty for the MCS IQ3 at the Savannah River Site*, Document No. TT-CD-001, 01/27/03
- NDA Batch Data Report SRNDA 002
- NDA Batch Data Report SRNDA 003

During the inspection, we assessed several technical elements of SRS CCP's NDA process (see Attachment A.2), including those discussed below.

1) The Mobile IQ3 system was assessed.

The IQ3 system is a gamma spectrometry system that uses high purity germanium (HPGe) detectors to quantify the radionuclides in a 55-gallon drum by detecting characteristic gamma-rays emitted when the radionuclides decay. Three collimated detectors each view a different vertical segment of the drum. Opposite each of these three detectors, on the other side of the drum are three ^{133}Ba transmission sources, used to correct for the attenuation of gamma-rays by the waste matrix. The drum is rotated on a turntable to average out radial non-homogeneities in the waste matrix and source distribution.

The three detectors are used to directly quantify a number of radionuclides, including ^{239}Pu, ^{241}Am, ^{233}U, ^{235}U, ^{238}U, ^{137}Cs, and ^{237}Np. Other radionuclides are quantified by

relating them to one of the directly measured radionuclides through a relative measurement, as described below. A pulser is used to correct for deadtime (the fraction of time that a detector is unable to detect a pulse because it is processing an earlier pulse). Data acquisition and analysis is performed using the Genie PC Gamma Waste Assay Software (GWAS) package running on a personal computer. Analysis is performed in one of two modes: a transmission source corrected measurement used for lower density waste matrices and a density-based correction used for higher density matrices.

In addition to the three collimated HPGe detectors described above, three low energy germanium (LEGe) detectors are used to measure the quantity of plutonium isotopes relative to a key isotope, typically ^{239}Pu. Plutonium isotopes quantified by relative measurements include ^{238}Pu, ^{240}Pu, and ^{241}Pu. The summed spectrum from the three LEGe is then analyzed with a Multigroup Analysis (MGA) software package.

Several radionuclides are required to be reported but can not be directly measured. These include ^{90}Sr, ^{234}U, and ^{242}Pu. These nuclides are typically quantified by relating their activity to the activity of one or more radionuclides that can be measured. The estimation of the activity of these radionuclides is described in Appendix 1 of *CCP Mobile IQ3 System Data Reviewing, Validating and Reporting Procedure*, Revision 1, CCP-TP-048, (03/21/03). This appendix failed to address the quantification of ^{242}Pu for wastes contaminated primarily with ^{238}Pu heat source waste, although the quantity of ^{242}Pu was calculated in software. This issue was included among the NDA concerns listed below.

2) The calibration of the Mobile IQ3 system was assessed.

The IQ3 system was calibrated in January 2003 for waste commonly referred to as job control waste. The IQ3 is calibrated for gamma-rays in the energy range from 59 keV to 1408 keV, using a set of six ^{241}Am/^{152}Eu line sources. The operating range is defined as 0 to 1 g ^{238}Pu and 0 to 15 g ^{239}Pu. The calibration is appropriate for low-Z $(Z < 15)$ waste matrices with densities up to 1.6 g/cm^3. The calibration is documented in *Calibration and Validation Report for the MCS IQ3 at the Savannah River Site,* Revision 1, Document No. MCS-SRS-NDA-0203 (03/14/03).

The calibration is verified once per week during operation by assaying a surrogate drum with a matrix and radioactive source similar to the waste being characterized. SRS intends to measure waste primarily containing either ^{238}Pu or ^{239}Pu by weight. While SRS possesses ^{239}Pu standards, no ^{238}Pu standards were available at the time of the inspection. Without such ^{238}Pu standards, it is unclear how SRS will verify the system's ability to accurately quantify ^{238}Pu heat source waste as part of the weekly interference check. This is addressed in more detail in the description of the NDA concerns below.

The calibration report also described the determination of the lower level of detection (LLD) for the ten WIPP-tracked radionuclides. The determination of the LLD or reporting threshold for ^{234}U given in the report was specific to weapons-grade plutonium (WGPu). The determination of the reporting threshold for ^{234}U for heat-source plutonium

(primarily ^{238}Pu) was not documented. This is addressed further in the NDA concerns below.

3) The total measurement uncertainty (TMU) of the Mobile IQ3 system was evaluated.

The determination of the TMU for the IQ3 system was documented in *Total Measurement Uncertainty for the MCS IQ3 at the Savannah River Site*, Revision 0, MCS-SRS-NDA-TMU-2003, (02/14/03). The TMU included components from counting statistics, calibration source strength and curve fitting, isotopic measurements, self-absorption effects, matrix non-homogeneity, source distribution, and end effects. The typical TMU, reported at the 95% confidence level was 60%, 46%, and 29% for drums containing 100 kg of steel, 50 kg of graphite, and 25 kg of combustibles, respectively.

4) Batch data reports were reviewed.

Batch data reports SRNDA 002 and SRNDA 003 were reviewed to ensure that all required results (i.e. radionuclide activities) were reported along with their associated uncertainties. All required information was included in the radioassay data sheets reviewed. In the course of reviewing the batch data reports, it was noted that the radioassay data sheet for container SR205316 reported a mass of ^{90}Sr that was inconsistent with the reported activity, based on the generally accepted value for the half-life of ^{90}Sr. This issue is included among the NDA concerns outlined below.

5) EPA replicate testing of the Mobile IQ3 system was performed and evaluated.

The purpose of the replicate testing performed as part of this inspection is to provide the EPA with an independent means to verify that the IQ3 can provide consistent, reproducible results for the determination of the quantity of ten WIPP-tracked radionuclides (^{241}Am, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{90}Sr, ^{233}U, ^{234}U, and ^{238}U) and the TRU alpha concentration. This is accomplished by reassaying drums previously characterized on the same system or instrument in order to:

- show that the instrument produces results consistent with the reported total measurement uncertainty (TMU), by comparing the sample standard deviation for a number of replicate measurements taken over several hours or days to the reported TMU; and

- show that the instrument provides reproducible results over longer periods of time, such as weeks or months, by comparing the results of the replicate measurement(s) to the original reported values.

As part of the inspection to certify IQ3 system, EPA asked that SRS reassay three (3) job control waste drums that EPA randomly selected from a list of drums previously assayed on the IQ3 system. The drums included drums SR164760, SR176807, and SR526246. Each of the drums was reassayed five (5) times. Two statistical tests, a chi

squared (χ^2) test and *t* test were performed for each container measured on the IQ3 system. Data and results of the statistical analysis are included in Attachments B.1-B.6.

The chi squared (χ^2) test for all three drums showed no statistically significant differences between the sample standard deviation and the reported TMU for any of the reported quantities. The *t* test showed statistically significant differences between the original measurement and the replicate measurements for the quantity of ^{237}Np for drums SR164760 and SR526246. In both instances, the test failed because of the very small relative sample standard deviation in the replicate measurements. Additionally, because the measured TRU alpha activity in drum SR526246 was primarily due to the quantity of ^{237}Np, the *t* test showed statistically significant differences for this quantity. No other statistically significant differences were observed.

Findings:

The EPA inspection team identified no NDA findings.

Concerns:

The EPA inspection team identified the following four (4) NDA concerns:

NDA Concern No. 1. The Waste Acceptance Criteria (WAC), DOE/WIPP-02-3122, Revision 0.1, requires at least once per operational week an interfering matrix be used to assess the long term stability of the NDA instrument's matrix correction. To that end, radioactivity standards and surrogate matrices must be selected so that over a six month period, the operating range of the assay system is tested in each applicable surrogate waste matrix. SRS anticipates assaying job control waste primarily contaminated with either weapons grade plutonium (WGPu) or ^{238}Pu heat source materials. At the time of the inspection, no ^{238}Pu standards were available for the weekly interference check. Weekly interference checks previous to the inspection had been performed using a 9 g WGPu source. CBFO issued an observation that the acquisition of a ^{238}Pu standard would to be necessary to fulfill this requirement. This concern requires a response.

NDA Concern No. 2. Appendix 1 of *CCP Mobile IQ3 System Data Reviewing, Validating and Reporting Procedure*, Revision 1, CCP-TP-048, (03/21/03) did not address the quantification of ^{242}Pu for wastes contaminated primarily with ^{238}Pu heat source waste, although the quantity of ^{242}Pu was calculated in software. CBFO identified this concern in Corrective Action Report (CAR) -03-051. This concern requires a response. On May 28th EPA received a copy of the CCPs response to the CBFO CAR. In their response the CCP addressed the issue in this EPA concern. Therefore this concern is considered closed.

NDA Concern No. 3. *Calibration and Validation Report for the MCS IQ3 at the Savannah River Site*, Revision 1, MCS-SRS-NDA-0203 (03/14/03) did not describe how the lower level of detection (LLD) for ^{234}U was determined for waste contaminated primarily with weapons grade plutonium. CBFO identified this concern in CAR-03-051. This concern requires a response. On May 28th EPA received a copy of the CCPs

response to the CBFO CAR. In their response the CCP addressed the issue in this EPA concern. Therefore this concern is considered closed.

NDA Concern No. 4. The radioassay data sheet for container SR205316, in Batch Data Report SR-NDA-003, provides a mass of ^{90}Sr that was inconsistent with the reported activity of ^{90}Sr, based on published values of the half-life and specific activity of ^{90}Sr. CBFO identified this concern in CAR-03-051. This concern requires a response. On May 28th EPA received a copy of the CCPs response to the CBFO CAR. In their response the CCP addressed the issue in this EPA concern. Therefore this concern is considered closed.

8.0 RESPONSE TO COMMENTS

We received no comments in Docket A-98-49 about this inspection.

9.0 SUMMARY OF RESULTS

The EPA inspection team determined that the processes that were inspected characterize the following wastes in accordance with 40 CFR 194.24(c)(4) as follows:

- The NDA IQ3 and its associated procedures were adequately implemented, pending resolution of the above mentioned concerns requiring a response.
- The AK process was adequately implemented

The EPA inspection team identified no findings and four (4) concerns.

9.1 Findings

The EPA inspection team identified no findings.

9.2 Concerns

The EPA inspection team identified the following four (4) concerns.

NDA Concern No. 1. The Waste Acceptance Criteria (WAC), DOE/WIPP-02-3122, Revision 0.1, requires at least once per operational week an interfering matrix must be used to assess the long term stability of the NDA instrument's matrix correction. To that end, radioactivity standards and surrogate matrices must selected so that over a six month period, the operating range of the assay system is tested in each applicable surrogate waste matrix. SRS anticipates assaying job control waste primarily contaminated with either weapons grade plutonium (WGPu) or ^{238}Pu heat source materials. At the time of the inspection, no ^{238}Pu standards were available for the weekly interference check. Weekly

interference checks previous to the inspection had been performed using a 9 g WGPu source. CBFO issued an observation that the acquisition of a ^{238}Pu standard would seem to be necessary to fulfill this requirement. This concern requires a response.

NDA Concern No. 2. Appendix 1 of *CCP Mobile IQ3 System Data Reviewing, Validating and Reporting Procedure*, Revision 1, CCP-TP-048, (03/21/03) does not address the quantification of ^{242}Pu for wastes contaminated primarily with ^{238}Pu heat source waste, although the quantity of ^{242}Pu is calculated in software. CBFO identified this concern in Corrective Action Report (CAR) -03-051. This concern requires a response. On May 28th EPA received a copy of the CCPs response to the CBFO CAR. In their response the CCP addressed the issue in this EPA concern. Therefore this concern is considered closed.

NDA Concern No. 3. *Calibration and Validation Report for the MCS IQ3 at the Savannah River Site*, Revision 1, MCS-SRS-NDA-0203 (03/14/03) does not describe how the lower level of detection (LLD) for ^{234}U is determined for waste contaminated primarily with weapons grade plutonium. CBFO identified this concern in CAR-03-051. This concern requires a response. On May 28th EPA received a copy of the CCPs response to the CBFO CAR. In their response the CCP addressed the issue in this EPA concern. Therefore this concern is considered closed.

NDA Concern No. 4. The radioassay data sheet for container SR205316, in Batch Data Report SR-NDA-003, provides a mass of ^{90}Sr that is inconsistent with the reported activity of ^{90}Sr, based on published values of the half-life and specific activity of ^{90}Sr. CBFO identified this concern in CAR-03-051. This concern requires a response. On May 28th EPA received a copy of the CCPs response to the CBFO CAR. In their response the CCP addressed the issue in this EPA concern. Therefore this concern is considered closed.

9.3 Conclusion

In summary, EPA's inspection incorporated waste characterization systems and processes at SRS that consisted of the following elements:

1. Acceptable Knowledge (AK) — The AK process associated with characterization of contact handled retrievably stored debris waste is adequate to identify and quantify waste material parameters for the observed debris wastes.

2. Nondestructive Assay (NDA) — The IQ3 system and associated procedures used by CCP at SRS are adequate to characterize the radiological constituents of contact handled debris (job control) waste, assuming that the NDA concerns described in this report are adequately addressed.

EPA concludes that CCP SRS continues to adequately characterize contact handled retrievably stored debris waste using the CCP AK and NDA systems.

Attachment A.1
Acceptable Knowledge Checklist

Attachment A.2
Nondestructive Assay Checklist

Attachment B.1
Replicate Data for Container SR164760

Attachment B.2
Replicate Test Results for Container SR164760

Attachment B.3
Replicate Data for Container SR176807

Attachment B.4
Replicate Test Results for Container SR176807

Attachment B.5
Replicate Data for Container SR526246

Attachment B.6
Replicate Test Results for Container SR526246

A.1 Acceptable Knowledge (AK) Checklist for Inspection EPA- SRS-CCP-03.03-8 March 24-26 2003 at SRS CCP

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Procedures require staff to be: • familiar with applicable technical procedures • familiar with QAOs • qualified to assemble, compile, and confirm AK data	CCP-TP-005 Revision 11	• Employee's explanation of job duties was consistent with applicable procedures • Employee could identify the mandatory AK items for assembly • Employee's identification of applicable procedures was correct • Employee adequately explained how to assemble, compile, and confirm data • Employees responsible for AK documentation were trained and qualified in accordance with applicable procedures	Y	Q&MIS 4.61 for WIPP. Examined training records for Anne Hallman and Julia Whitworth. Qual Cards/documentation of AK training was examined. Personnel performing AK understood job duties, and were trained to applicable procedures. Personnel responsible for AK were trained and qualified.
Procedures demonstrate a logical progression from general facility information to more detailed waste stream-specific information	CCP-TP-005 Revision 11	This logical sequence can be demonstrated through traceability analysis. (Traceability analysis and linkages may include but need not be limited to individual container data for radionuclides and waste material parameters, IDCs, and waste streams.) AK documentation is traceable to the drum level	Y	Examined Waste Stream 4 (HB Line Debris) data for containers ST164760, SR176807, ST526246. Batch Data Reports SRRTR04929, SRRTR0428, SRRt0444, SRNDA004 SRNDA001, SRNDA002; Burial Ground Records for above containers; also examined references including C028, D048, D052, D006, D040. No WSPF for Waste Stream 4 prepared; examined WSPF for WS 2 (FB HET Pre86). Examined data show that information for containers is traceable and logical progression from general to specific information can be demonstrated.
Procedures for AK processes are consistent with each other	CCP-TP-005 Revision 11, CH WAC, Rev.0; SRS Certification Plan	Procedures for AK processes are implemented consistently	Y	AK Procedures are consistent; CCP-TP-005 could be improved to require write-up that accompanies AK Accuracy Checklist.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
The site's TRU waste management program has procedures to determine: • waste categorization schemes (e.g., consistent definitions of waste streams) and terminology • breakdown of the types and quantities of TRU waste generated/stored at the site • how waste is tracked and managed at the generator site (including historical and current operations)	CCP-TP-005 Revision 11, CH WAC, Rev.0		Y	CCP-AK-SRS-4, Rev.1; D034, M066, C026, C105, C126, C135, M079, D034; CCP Weekly Report ending 3-23-03. HB HET and HET A waste categorization schemes based on WMC/chemical parameters, not radionuclides. Breakdown of types/quantities of these waste streams was excellent; other HB line waste streams are yet to be completed, but it is recommended that overlapping information from HB HETA to HET B, etc., is adequately referenced. Waste tracked through CCP Weekly Reports and SRS COBRA database.
Procedures call for AK information to be collected for: • ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, ^{137}Cs + unexpected radionuclides • ferrous metals (in containers) • cellulosics, plastics, rubber • nonferrous metals (in containers) **From CH WAC:** **1. Specify isotopes/quantities defined by AK** **–must be appropriate and result in unbiased values for cumulative activity and mass of radionuclides**	CCP-TP-005 Revision 11, CH WAC, Rev.0	AK information is collected for: • ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, ^{137}Cs + unexpected radionuclides • ferrous metals (in containers) • cellulosics, plastics, rubber • nonferrous metals (in containers) **From CH WAC:** **Is AK information collected for isotopes?**	Y	CCP-AK-SRS-4, Rev.1, Section 5.4.1-5.4.2. C040, D154, D056, D052, C028, D006, D034, M066, M014. Radionuclide information very well presented; WMP data are adequately addressed, but are of lesser detail. Note that site cannot differentiate between ferrous/nonferrous material. Table 5-1 generated using data from burial ground records. Information is collected for isotopes; site has also collected, assembled, and assessed FSNs which are individual bag-specific assay data attached to burial ground records. AK Summary could be improved by addressing specific fission isotopes and decay products; also, to differentiate those containers that may have "no" radionuclides based on conservative assumptions that were made in the past.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Procedures require documentation of radionuclide process origin	CCP-TP-005 Revision 11 CH WAC, Rev.0	Identified radionuclides and their isotopic distributions are consistent and accurate	Y	CCP-AK-SRS-4, Rev.1; D-57, C028, D050, D006. Based on limited review of references, data presented in AK Summary appears to be consistent with that in the references. Isotopic distributions are identified and presented, with "top 2" radionuclides specified. Note that ^{242}Pu, ^{90}Sr, and ^{234}U are all calculated values with respect to NDA; their presence with respect to AK documentation should be addressed, particularly if these are expected decay products. Documentation of radionuclide process origin is very good. Note that the isotopic distributions are very complex, based upon the different uses and campaigns that occurred at the HB. While differentiation of waste by radionuclide is not required and may not be accomplishable for HB, future uses of AK should take into account radionuclide distribution, as possible, with respect to waste stream definitions.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
	CCP-TP-005 Revision 11 CH WAC, Rev.0	Radionuclides identified by AK and isotopic distributions are provided to NDA/Radioassay personnel. If AK data are provided to NDA personnel, data are available to operators prior to determination of isotopic quantities. Data use and limitations are well defined (refer to NDA checklist).	Y	NDA Personnel are updated and trained with respect to AK data, and the AK Summaries, as well as AK References are available to NDA personnel. Note that NDA, to date, has relied upon AK to provide general isotopic information; data limitations are well defined in AK documentation. Also, it is apparent that AK data show some containers may have no measurable radionuclide quantities; it is recommended that these containers by identified, if possible, and shared with NDA personnel.
Procedures require: • Assembling AK information • Compiling AK documentation into an auditable record (the process should include review of AK information to determine the waste material parameters and radionuclides present, as well as source info discrepancy resolution) • Assigning waste streams/waste matrix codes • Identifying physical forms, waste material parameters, and radionuclides (including, if possible, isotopic ratios) • Resolving data discrepancies • Identifying management controls for discrepant items/containers/waste streams. • Confirming AK information with other analytical results (done by comparing AK characterization data with that obtained through NDE and/or visual examination, including discrepancy resolution) • Auditing of AK records.	CCP-TP-005 Revision 11 CH WAC, Rev.0	Compilation of AK documentation is adequately demonstrated	Y	CCP-AK-SRS-4, Rev.1; attachments 1-6, Attachment 13 (WS 4); Attachments 120, 11, 12 for WS 2. D048, D050, D057, C028, M011, M066, M102, M104, D006, D034, D052, D058, C009, C026, C040, C045, C105, C126, C135, C154, D056, M079, DR010, DR004. CCP-TP-066, Rev.0 (Fast Screen), COBRA print outs for containers SR164760, SR526246, SR176807. CCP process adequately assembled, compiled, and assigned/identified waste streams. DR010 and DR004 are examples of data discrepancies/NCRs. DR010 deals with the choice of the site to use Burial Ground records over the GoWest database for radionuclide information, as the database had incorrect algorithms. Confirmation was not complete for WS 4; elements for WS 2 (Attachments

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
		Discrepancies are adequately resolved		10, 11, 12 of CCP-TP-005) were examined with respect to AK confirmation. Internal Audit Report I02-07 examined. Appeared that data are adequately assembled/examined, and that data discrepancies sufficiently resolved. Fast Screen is a "quick" RTR method to identify containers with prohibited items (i.e. water); this is an AK supplemental data acquisition activity that quickly identifies problematic containers.
From CH-WAC 1.If AK used (i.e.data collected prior to QA program)- what method was employed to qualify-peer review, corroborating data, confirmatory testing, QA program equivalency? 2. At a minimum, to confirm existing AK data, it is necessary to compare ratios of the two most prevalent radionuclides in the isotopic mix <u>2. 238, 239, 240, 241, 242 Pu and 241Am:</u> -Confirmation can be accomplished via comparison of measured and AK values for ^{239} Pu/ ^{240} Pu for wgpu; ^{238}Pu/ ^{239}Pu for heat source. - Measured ^{241}Am can be used to calculate 241Pu (for subsequent AK comparison) if time of chemical separation is known (no ^{241}Am at time of separation assumed) - ^{241}Pu can be compared (by ratio) to confirm AK of any Pu isotope associated with wg/rg (i.e.^{239}Pu or ^{240} Pu) - ^{238}Pu from AK for wg/rg Pu is assumed to be valid if the AK values of ^{239}Pu and ^{240}Pu have been confirmed by measurement. -^{242}Pu calculated by correlation techniques since it can't be measured	CCP-TP-005 Revision 11 CH WAC, Rev.0	AK confirmation based on NDE and/or visual examination is adequately demonstrated	Y	CCP-AK-SRS-4, Rev.1. Site AK personnel do not use or assess radionuclide content/confirmation using the CH-WAC allowances; AK assembles all data independently, and NDA measures each radionuclide except for ^{242}Pu, ^{90}Sr and ^{234}U, which are calculated or scaled. Note that the occurrence of these isotopes are noted as part of AK Accuracy assessments, but if one of the calculated values is not a "top 2" radionuclide, the AKE does not address. This could be problematic because the NDA results show the presence of calculated isotopes that are not reflected in the AK Summaries. It is recommended that the AK Summaries address all of the 10 EPA isotopes, and that the presence of the above isotopes be better addressed (i.e. discuss daughter products, absence of specific fission products, etc). This is to ensure that the AK Summaries present information congruent with that reported through NDA.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
3. 235U, 233U, 238U, 234U were they tracked or measured in AK information? -If no valid AK exists, data generated can only be used to detect or calculate, or confirm absence - ratios for ^{234}U calculated from ^{235}U enrichment - if valid AK exists can confirm with certified systems -^{234}U calculated by ^{235}U enrichment because ^{234}U can't be measured 4. ^{137}Cs and ^{90}Sr -confirmed by WIPP certified system (direct measurement or comparison of ^{241}Am peak at 662 kv to other ^{241}Am peaks (disproportionate ^{241}Am peak at 662 kv could mean presence of ^{137}Cs) - 90 Sr calculated from ^{137}Cs using scaling factors 5. Other radionuclides- must identify via NDA and should identify via AK				(see above). Also, AK documents the presence of "other" radionuclides, particularly 237Np; see table 5-4 of CCP-AK-SRS-4, Rev.1. Also see reference D058.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Procedures require that: • AK information be compiled in an auditable record, including a road map for all applicable information. • A reference list be provided that identifies documents, databases, Quality Assurance protocols, and other sources of information that support AK information. • The overview of the facility and TRU waste management operations in the context of the facility's mission be correlated to specific waste stream information. • Correlations between waste streams, with regard to time of generation, waste generating processes, and site-specific facilities be clearly described. For newly generated wastes, the rate and quantity of waste to be generated shall be defined. • Nonconforming waste be segregated.	CCP-TP-005 Revision 11 CH WAC, Rev.0	• AK information is compiled in an auditable record, including a road map for all applicable information. • A reference list is provided that identifies documents, databases, Quality Assurance protocols, and other sources of information that support AK information. • The overview of the facility and TRU waste management operations in the context of the facility's mission is correlated to specific waste stream information. • Correlations between waste streams, with regard to time of generation, waste generating processes, and site-specific facilities is clearly described. For newly generated wastes, the rate and quantity of waste to be generated are defined. • Nonconforming waste is segregated.	Y	CCP-TP-005, Attachment 4 is waste-stream specific reference list. Also have general AK reference list, and Attachment presents mandatory/supplemental information cross references..Also see CCP-AK-SRS-4, Rev.1 and other AK summaries (SRS1-3), and example references M011, M066, D004, D054, D050. SRS should ensure that AK data common to different waste streams are adequately cross referenced. SRS does a good job of assembling and discussing AK data, including facility overviews and TRU waste management activities in the context of facility missions. Also, example QP-005 of NCR dealt with rejection of items for present of prohibited items.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Procedures require that the following information will be included in the AK record: • Map of the site that identifies the areas and facilities involved in TRU waste generation, treatment, and storage • Facility mission description related to TRU waste generation and management • Description of the operations that generate TRU waste at the site and process information, including: -Area(s) or building(s) from which the waste stream was or is generated -Estimated waste stream volume and time period of generation -Waste generating process description for each building or area -Process flow diagrams, if appropriate -Generalized material inputs or other information that identifies the radionuclide content of the waste stream and the physical waste form • Types and quantities of TRU waste generated, including historical generation through future projections **From CH-WAC** • **waste identification/categorization schemes relevant to the isotopic composition of waste and description of isotopic composition of each waste stream** • **physical/chemical waste composition that could affect isotopic distribution (i.e. processes to remove ingrown 241am)** • **statement of all numerical adjustments applied to derive the material's isotopic distribution e.g. scaling factors, decay/ingrowth corrections and secular equilibrium considerations** • **specification of isotopic ratios for the 10 WIPP-tracked radionuclides and, if applicable, the radionuclides that comprise 95% of the hazard**	CCP-TP-005 Revision 11 CH WAC, Rev.0	The following information is included in the AK record: • Map of the site that identifies the areas and facilities involved in TRU waste generation, treatment, and storage • Facility mission description related to TRU waste generation and management • Description of the operations that generate TRU waste at the site and process information, including: -Area(s) or building(s) from which the waste stream was or is generated -Estimated waste stream volume and time period of generation -Waste generating process description for each building or area -Process flow diagrams, if appropriate -Generalized material inputs or other information that identifies the radionuclide content of the waste stream and the physical waste form • Types and quantities of TRU waste generated, including historical generation through future projections **From CH-WAC** • **waste identification/categorization schemes relevant to the isotopic composition of waste and description of isotopic composition of each waste stream** • **physical/chemical waste composition that could affect isotopic distribution (i.e. processes to remove ingrown 241am)** • **statement of all numerical adjustments applied to derive the material's isotopic distribution e.g. scaling factors, decay/ingrowth corrections and secular equilibrium considerations** • **specification of isotopic ratios for the 10 WIPP-tracked radionuclides and, if applicable, the radionuclides that comprise 95% of the hazard**	Y	CCP-AK-SRS-4, Rev. 1, Sections 5.1.1-5.2; Appendix 1; references D048, D034, D058, The facility uses the Attachment 1 (CCP-TP-005 Rev 11) checklist to show that appropriate references have been assembled for each of the required and supplemental information areas. Also, the site showed that Attachment 1 elements DR5, SW11, D48, and D58 address the required information from the CH-WAC, including categorization schemes, waste composition, numerical adjustments, and isotopic ratios. It is recommended that the site include, in the AK record, those isotopes not specifically mentioned in the AK record but expected due to decay (i.e. daughter products); it is also suggested that the site specifically indicate those isotopes that are derived through numerical adjustments to ensure that appropriate correlation between the AK record and NDA results is achieved (i.e. so that results presented in the NDA are addressed, in some fashion, in the AK record with respect to daughter and fission products).

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
The site has procedures for the collection of supplemental information.	CCP-TP-005 Revision 11 CH WAC, Rev.0	Samples of supplemental information are sufficiently detailed and are appropriate to the waste being characterized. **From CH-WAC** **Examples of supplemental information include:** • **safeguards and security and other material control systems/programs** • **reports of nuclear safety or criticality, accidents involving SNM** • **waste packaging, waste disposal, building or nuclear material management area logs or inventory records, site databases that provide SNM or nuclear material information** • **test plans, research project reports, or laboratory notebooks that describe the radionuclide content of materials used in experiments** • **information from site personnel** • **historical analytical data relevant to isotopic distribution of the waste stream**	Y	CCP-AK-SRS-4, Rev.1; Attachment 1 of CCP-TP-005, Rev.11. The site uses Attachment 1 to show all references associated with supplemental data acquisition. Note that specific to CH-WAC requirements, Attachment 1 elements S14, S15, and S5 address these specific supplemental needs.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Site documents/procedures require the facility prepare an AK summary document that summarizes all information collected, including the basis for all waste stream designations.	CCP-TP-005 Revision 11 CH WAC, Rev.0	The AK summary is available for EPA review and contains the required information, including the basis for all waste stream designations.	Y	CCP-AK-SRS-4, Rev.1. The AK Summaries for the HB HET and HETA are exceptionally well prepared and included detail typically not presented in AK Summaries. As appropriate, HB HET B, and other HB waste streams should better reference overlapping information from the HB HET and HET A AK Summaries. Also, fission/daughter products could be better addressed, as could identification of wastes that may contain no radionuclides as evidenced by conservative assumptions made in the past.
Site procedures require that additional information be collected before waste may be shipped if the required AK information is not available for a waste stream.	CCP-TP-005 Revision 11 CH WAC, Rev.0	Additional information is collected before waste may be shipped if the required AK information is not available for a waste stream.	Y	The site is currently segregating waste, and no examples of waste with unavailable AK data have been found to date. Site intends to use the Fast Scan process to obtain limited RTR (AK) data, and to segregate problematic containers.
The site has a written procedure for the confirmation of AK information using analytical data, including NDA/NDE and/or VE. This procedure applies to both retrievably stored and newly generated waste. This procedure requires a reevaluation of AK if NDE/NDA or VE identify it to be a different waste matrix code. This procedure describes how the waste must be reassigned, based on the AK reevaluation.	CCP-TP-005 Revision 11 CH WAC, Rev.0	AK information is confirmed using analytical data, including NDA/NDE and/or VE. Has the acceptable knowledge expert calculated the percent changes in matrix parameter categories (MPCs) based on AK and NDE/VE? Were accuracy evaluations assigned? Are these acceptable?	Y, in part	The site has not performed AK confirmation on WS 4 presented in CCP-AK-SRS-4, Rev.1. However, confirmation/AK Accuracy were assessed for WS 2 (CCP-AK-SRS-2, FB Line Pre86). Examination of these data show that improvements to the AK Accuracy report could be made in the areas of addressing calculated isotopes, more detail in accompanying write-ups, tracking of WMP and radionuclide outliers, and to ensure written text accompanying AK is consistent with associated reference material.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Procedures require the following steps to be followed if wastes are reassigned to a different waste matrix code based on NDA/NDE or VE: • Review existing information based on the container identification number and document all differences • Reassess and document all analytical data associated with the waste • Reevaluate waste material parameter determinations and document any changes • Reevaluate the radionuclide content and document any changes • Verify and document that the reassigned waste matrix code was generated within the specified time period, area and buildings, waste generating process, and that the process material inputs are consistent with the waste material parameters identified during radiography or visual examination • Record all changes to acceptable knowledge records • If discrepancies exist in the acceptable knowledge information for the reassigned waste matrix code, complete a nonconformance report, document the segregation of this container, and define the corrective actions necessary to fully characterize the waste	CCP-TP-005 Revision 11 CH WAC, Rev.0	The following steps are followed if wastes are reassigned to a different waste matrix code: • Review existing information based on the container identification number and document all differences • Reassess and document all analytical data associated with the waste • Reevaluate waste material parameter determinations and document any changes • Reevaluate the radionuclide content and document any changes • Verify and document that the reassigned waste matrix code was generated within the specified time period, area and buildings, waste generating process, and that the process material inputs are consistent with the waste material parameters identified during radiography or visual examination • Record all changes to acceptable knowledge records • If discrepancies exist in the acceptable knowledge information for the reassigned waste matrix code, complete a nonconformance report, document the segregation of this container, and define the corrective actions necessary to fully characterize the waste	Y	NCR-SRS-0303-03, Attachments 10-12 of CCP-TP-005, Rev. 11 (for WS-2 only; unavailable for WS-4). M39. Review of SRS RTR data showed that the site had originally erroneously separated WS-2 out into two waste streams—one organic and the other inorganic. However, RTR revealed that the WS should instead be a single waste stream, and waste were then re-evaluated under the new WMC assignment (see reference M39). Also, NCR 0303-03 dealt with the inability of RTR to see through impenetrable material; this drum SR138930 was segregated and rejected. To date, problematic containers are segregated and are not eligible for shipment to WIPP.
The site has procedures for shipment revocation and procedures for notification of CAO when a container is revoked?	CCP-TP-005 Revision 11 CH WAC, Rev.0	Has a waste stream been revoked based either on AK information or reassessment as part of reconfirmation? If so, was the procedure(s) followed?	Y	See above.

Establishment of Required Technical Elements in Procedures	Y/N Location	Execution of Procedures	Y/N	Objective Evidence/ Comment
Until discrepancies are resolved, shipment of the waste stream to the WIPP is prohibited.	CCP-TP-005 Revision 11 CH WAC, Rev.0	If data consistently indicate discrepancies with acceptable knowledge information, the site increases sampling, reassesses the materials and processes that generate the waste, and resubmits waste stream profile information.	Y	See above; a new WSPF was submitted for WS-2 recognizing the combination of organic and inorganic waste streams.

A.2 Nondestructive Assay (NDA) Checklist for Inspection EPA-SRS-CCP-03.03-8 March 24-26 2003 at SRS CCP

Establishment of Required Elements in Procedures	Y/N	Location	Execution of Procedures or Verification of Activity	Y/N	Objective Evidence or Comment
General Reporting Requirements					
Procedures require assay systems to report quantitative values and uncertainties for ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs.	Y	CCP-PO-002, Revision 5, Section A.1, Page 80	Quantitative values and uncertainties for ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, 241Am, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs are reported.	Y	Reviewed Batch Data Reports SRNDA 002 and SRNDA 003
Procedures require that each payload container disposed of at WIPP contains TRU waste.	Y	CCP-PO-002, Revision 5, Section A.1, Page 80	Containers to be disposed of at WIPP meet the definition of TRU waste.	Y	Reviewed Batch Data Reports SRNDA 002 and SRNDA 003 Discussion with CCP-SRS personnel
NDA instruments and procedures are appropriate for the waste streams and/or waste content codes being assayed.	Y	CCP-PO-002, Revision 5, Section A.1, Page 81	NDA instruments and procedures are appropriate for the waste streams and/or waste content codes being assayed.	Y	Reviewed *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03) Discussion with CCP-SRS personnel
NDA instruments and procedures result in unbiased values for the cumulative activity of the WIPP radionuclide inventory.	Y	CCP-PO-002, Revision 5, Section A.1, Page 81	NDA instruments and procedures result in unbiased values for the cumulative activity of the WIPP radionuclide inventory.	Y	Reviewed *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03)
Acceptable Knowledge (AK)					
Isotopic ratios for use in qualifying radionuclides are performed by direct measurement or, when AK is used, are qualified by confirmatory testing.	Y	CCP-PO-002, Revision 5, Section A.2, Pages 82-86	Isotopic ratios for use in quantifying radionuclides are performed by direct measurement or, when AK is used, are qualified by confirmatory testing.	Y	Isotopic ratios are directly measured using Multigroup Analysis (MGA) software. Note ^{90}Sr, ^{234}U, and ^{242}Pu quantified by correlation.
Lower Level of Detection					
Procedures require that the lower limit of detection (LLD) for each NDA system is determined.	Y	CCP-PO-002, Revision 5, Section A.3, Page 88	The lower limit of detection (LLD) for each NDA system has been determined.	N	LLD for radionuclides defined in Section 10 of *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03) LLD for ^{234}U is not defined for waste contaminated

					primarily with WGPu
NDA instruments performing TRU/low-level waste discrimination measurements are required to have a LLD no greater than 100 nCi/g.	Y	CCP-PO-002, Revision 5, Section A.3, Page 88	NDA instruments performing TRU/low-level waste discrimination measurements are required to have a LLD no greater than 100 nCi/g.	Y	MDC defined in defined in Section 10 of *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03) MDC is less than 100 nCi/g for WGPu
Procedures require that site specific environmental backgrounds and container specific interferences must be accounted for in LLD determinations.	Y	CCP-PO-002, Revision 5, Section A.3, Page 88	Site specific environmental backgrounds and container specific interferences are accounted for in LLD determinations.	Y	LLD for measured radionuclides determined for each measurement and reported on the radioassay data sheets
Total Measurement Uncertainty (TMU)					
The method used to calculate the total measurement uncertainty (TMU) for all required quantities must be documented and technically justified.	Y	CCP-PO-002, Revision 5, Section A.3, Page 88	The method used to calculate the total measurement uncertainty (TMU) for all required quantities are documented and technically justified.	Y	TMU method is documented in *Total Measurement Uncertainty for the MCS IQ3 at the Savannah River Site*, Revision 0, (02/14/03)
Methods to determine TMU must be reviewed and approved by CBFO for each NDA instrument.	Y	CCP-PO-002, Revision 5, Section A.3, Page 88	Methods to determine TMU have been reviewed and approved by CBFO for each NDA instrument.	Y	TMU method reviewed and approved by CBFO technical specialist P. Kelly
Calibration					
Procedures require that each NDA instrument is calibrated before its initial use.	Y	CCP-PO-002, Revision 5, Section A.3, Page 88	The NDA instrument has been calibrated before its initial use.	Y	Calibration performed in January 2003 and documented in *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03)
Site procedures must specify the range of applicability of system calibrations.	Y	CCP-PO-002, Revision 5, Section A.3, Page 88	The range of applicability of system calibrations has been specified.	Y	IQ3 calibrated for gamma-rays between 59 keV and 1408 keV. Operating range: 0 to 1 g ^{238}Pu and 0 to 15 g ^{239}Pu
Procedures require that any matrix/source surrogate waste combinations are representative of the activity ranges and relevant waste matrix characteristics (i.e. densities, effective atomic number, neutron absorber and moderator content) planned for measurement by the system.	Y	CCP-PO-002, Revision 5, Section A.3, Page 88	Matrix/source surrogate waste combinations used are representative of the activity ranges and relevant waste matrix characteristics planned for measurement by the system.	Y	IQ3 is calibrated for low Z waste matrices ($Z < 15$) for densities up to 1.6 g/cm^3, appropriate for job control waste

Procedures require the use of consensus standards, when such standards exist. If consensus standards do not exist, the calibration technique must be approved by CBFO.	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	Consensus standards have been used, when such standards exist. If consensus standards do not exist, the calibration technique has been approved by CBFO.	Y	Six $^{241}Am/1^{52}Eu$ line sources used
Procedures require that primary standards be obtained from suppliers maintaining a nationally accredited measurement program.	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	Primary standards have been obtained from suppliers maintaining a nationally accredited measurement program	Y	Reviewed certificates of certification for the six $^{241}Am/1^{52}Eu$ line sources used, included in the calibration report
Calibration Verification					
Procedures require that verification of an NDA instrument's calibration is performed after any of the following occurrences: major system repairs and/or modifications, replacement of the system's components, significant changes to the system's software, and relocation of the system.	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	Verification of an NDA instrument's calibration has been performed when required.	Y	Discussion with CCP-SRS personnel. No recalibration has been required to date.
Procedures require recalibration of the system if the calibration verification demonstrates that the system's response has significantly changed.	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	Recalibration of the system has been performed if the calibration verification demonstrates that the system's response has significantly changed.	Y	Discussion with CCP-SRS personnel. No recalibration has been required to date.
Calibration Confirmation					
Procedures require confirmation of the calibration of a system by performing replicate measurements of a non-interfering matrix.	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	The calibration of a system has been confirmed by performing replicate measurements of a non-interfering matrix.	Y	Calibration confirmation is documented in Section 9.2 of *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03)
Procedures require that replicate measurements be performed with containers of the same nominal size as those used for actual waste assays.	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	Replicate measurements have been performed with containers of the same nominal size as those used for actual waste assays.	Y	Six replicate measurements have been performed using nominal masses 1; 3.3 and 10 g WGPu
Procedures require that replicate measurements be performed according to the same procedures used for actual waste assays.	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	Replicate measurements have been performed according to the same procedures used for actual waste assays.	Y	Reviewed Section 9.2 of *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03) Discussion with CCP-SRS personnel
Procedures require that replicate measurements be performed using nationally recognized standards or standards derived from nationally	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	Replicate measurements have been performed using nationally recognized standards or standards derived from nationally recognized standards that span	Y	NTP WGPu sources used.

recognized standards that span the range of use of the instrument.			the range of use of the instrument.		
Procedures require that the standards used for calibration confirmation are not the same sources for the most recent calibration.	Y	CCP-PO-002, Revision 5, Section A.3, Page 89	The standards used for calibration confirmation are not the same sources for the most recent calibration.	Y	NTP sources used for confirmation are not the same as $^{241}Am/^{152}Eu$ sources used for calibration
Requirements for accuracy, expressed as %R, and precision, expressed as %RSD, must be met.	Y	CCP-PO-002, Revision 5, Section A.3, Page 90	Requirements for accuracy and precision have been met.	Y	Reviewed Section 9.2 of *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03)
General Quality Control					
Procedures require that all radioassay and data validation be performed by appropriately trained and qualified personnel.	Y	CCP-PO-002, Revision 5, Section A.4.1, Page 92	All radioassay and data validation has been performed by appropriately trained and qualified personnel.	Y	Discussion with operators/reviewers T. Shepley and C. Davidson
Procedures require that requalification of personnel be based on evidence of continued satisfactory performance and is performed at least every two years.	Y	CCP-PO-002, Revision 5, Section A.4.1, Page 92	Requalification of personnel be based on evidence of continued satisfactory performance has been performed at least every two years.	Y	Requalification has not yet been required
Procedures require that all computer programs, including spreadsheets used for data reduction or analysis, meet the applicable requirements in the QAPD.	Y	CCP-PO-002, Revision 5, Section A.4.1, Page 92	All computer programs, including spreadsheets used for data reduction or analysis, meet the applicable requirements in the QAPD.	Y	Discussion with CCP-SRS personnel. Software modified to include heat source plutonium.
Procedures require that site participate in any relevant measurement comparison programs sponsored or approved by CBFO, including the Performance Demonstration Program (PDP).	Y	CCP-PO-002, Revision 5, Section A.4.1, Page 92	The site has participated in relevant measurement comparison programs sponsored or approved by CBFO.	Y	PDP measurements made for Cycle 9C performed in March 2003. No report had been issued at the time of the inspection.
Background and Performance Checks					
Procedures require daily background measurements, unless otherwise approved by CBFO. Contributions to backgrounds from nearby radiation sources must be carefully controlled, or more frequent backgrounds must be measured.	Y	CCP-TP-047, Revision 1, Section 4.3, Pages 10-13	Daily background measurements have been taken, unless otherwise approved by CBFO. Contributions to backgrounds from nearby radiation sources have been carefully controlled.	Y	Discussion with CCP-SRS personnel. Visual examination of NDA system and nearby surroundings.
Procedures require that system performance checks be performed at least once per operational day.	Y	CCP-TP-047, Revision 1, Section 4.5, Pages 16-19	Performance checks have been performed at least once per operational day.	Y	Reviewed control charts in Batch Data Reports SRNDA 002 and SRNDA 003
System performance checks must include, as applicable, efficiency, matrix correction checks, and for spectrometry systems peak position and resolution.	Y	CCP-TP-047, Revision 1, Section 4.5, Pages 16-19	Performance checks include, as applicable, efficiency, matrix correction checks, and for spectrometry systems peak position and resolution.	Y	Performance checks use a ^{137}Cs source.
Procedures require that at least once per	Y	CCP-TP-047, Revision 1,	An interfering matrix is used to assess the	Y	Documented in Section

operational week an interfering matrix is used to assess the long term stability of the NDA instrument and its matrix corrections.		Section 4.6, Pages 20-25	long term stability of the NDA instrument and its matrix corrections at least once per operational week.		11.2 of *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03)
Procedures require that interfering surrogate waste matrices be constructed in a way that the matrix characteristics do not change over time.			Interfering surrogate waste matrices have been constructed in a way that the matrix characteristics do not change over time.	Y	PDP combustibles drum used for the weekly interference check.
Procedures require that sources used for performance checks either be long-lived or decay-corrected.			Sources used for performance checks either are long-lived or decay-corrected.		^{137}Cs source has a 30 year half-life.
Procedures require that performance checks be quantitative and based on 2 and 3 sigma limits.	Y	CCP-PO-002, Revision 5, Section A.4.2, Page 93 CCP-TP-047, Revision 1, Section 4.5, Pages 16-19	Performance checks are quantitative and based on 2 and 3 sigma limits.		Reviewed control charts in Batch Data Reports SRNDA 002 and SRNDA 003 Documented in Section 11.1 of *Calibration and Validation Report for the Savannah River Site*, Revision 1, (03/14/03)
Data Management					
Procedures require that all radioassay data be reviewed and approved by qualified personnel before being reported to WWIS.	Y	CCP-PO-002, Revision 5, Section A.5.1, Page 96	All radioassay data has been reviewed and approved by qualified personnel before being reported to WWIS.	Y	Reviewed Batch Data Reports SRNDA 002 and SRNDA 003
Procedures require that radioassay testing batch reports consist of the following: • Testing facility name, testing batch number, container numbers, and signature of the Site Project Officer (SPO) or designee(s) • Table of Contents • Background and performance check data or control charts for the relevant time period. • Data validation per the QAPD and site procedures • Separate testing report sheets for each container.	Y	CCP-PO-002, Revision 5, Section A.5.2, Pages 97-98	Radioassay testing batch reports consist of the following: • Testing facility name, testing batch number, container numbers, and signature of the Site Project Officer (SPO) or designee(s) • Table of Contents • Background and performance check data or control charts for the relevant time period. • Data validation per the QAPD and site procedures • Separate testing report sheets for each container.	Y	Reviewed Batch Data Reports SRNDA 002 and SRNDA 003
Procedures require that testing report sheets include: • Title "Radioassay Data Sheet"	Y	CCP-PO-002, Revision 5, Section A.5.2, Pages 97-98 CCP-TP-048, Revision 1,	Testing report sheets include: • Title "Radioassay Data Sheet" • Method/procedure used	Y	Reviewed Batch Data Reports SRNDA 002 (Containers SR526214, SR526254, SR164781,

• Method/procedure used • Date of radioassay • Activities and associated TMU for for individual radionuclides • TRU alpha concentration and its associated TMU • Operator signature • Reviewer signature		Section 4.5, Page 13	• Date of radioassay • Activities and associated TMU for for individual radionuclides • TRU alpha concentration and its associated TMU • Operator signature • Reviewer signature		SR176835, SR526205, SR526219, SR175754, SR526193, SR526246, SR540579, SR540562, SR163637, SR202580, SR540584) and SRNDA 003 (Containers: SR215144, SR216298, SR540539, SR205316, SR176873, SR176765, Sr540586)
Procedures require that the following nonpermanent records be maintained at the radioassay-testing facility or forwarded to the site project office: • Testing batch reports • All raw data, including instrument readouts, calculation records, and radioassay QC results • All applicable instrument calibration reports	Y	CCP-PO-002, Revision 5, Section A.5.3, Page 98 CCP-TP-048, Revision 1, Section 4.6, Pages 13-14	The following nonpermanent records be maintained at the radioassay-testing facility or forwarded to the site project office: • Testing batch reports • All raw data, including instrument readouts, calculation records, and radioassay QC results • All applicable instrument calibration reports	Y	Data is backed up temporarily to Zip disks and later burned to a compact disc (CD)

Attachment B.1 Replicate Data for Container SR164760

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{234}U Activity (Ci)	1.28E-06	2.64E-07	20.7%	1.40E-06	3.19E-07	22.8%	1.51E-06	2.99E-07	19.8%
^{238}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}Pu Activity (Ci)	7.23E-03	1.50E-03	20.7%	7.96E-03	1.81E-03	22.7%	8.58E-03	1.70E-03	19.8%
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{242}Pu Activity (Ci)	2.21E-09	4.59E-10	20.8%	2.43E-09	5.54E-10	22.7%	2.62E-09	5.18E-10	19.8%
^{241}Am Activity (Ci)	1.68E-05	2.68E-06	16.0%	1.66E-05	2.65E-06	16.0%	1.73E-05	2.77E-06	16.0%
^{237}Np Activity (Ci)	3.92E-06	6.23E-07	15.9%	3.86E-06	6.13E-07	15.9%	3.86E-06	6.13E-07	15.9%
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
TRU Alpha Conc. (nCi/g)	483	100	20.7%	532	121	22.7%	574	113	19.7%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{234}U Activity (Ci)	1.18E-06	2.64E-07	22.4%	1.36E-06	3.23E-07	23.7%	1.34E-06	2.78E-07	20.8%
^{238}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}Pu Activity (Ci)	6.70E-03	1.50E-03	22.4%	7.76E-03	1.83E-03	23.6%	7.58E-03	1.58E-03	20.8%
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{242}Pu Activity (Ci)	2.05E-09	4.59E-10	22.5%	2.37E-09	5.61E-10	23.7%	2.32E-09	4.83E-10	20.8%
^{241}Am Activity (Ci)	1.71E-05	2.74E-06	16.0%	1.68E-05	2.68E-06	16.0%	1.69E-05	2.71E-06	16.0%
^{237}Np Activity (Ci)	3.87E-06	6.14E-07	15.9%	3.84E-06	6.10E-07	15.9%	3.86E-06	6.13E-07	15.9%
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
TRU Alpha Conc. (nCi/g)	448	100	22.3%	519	122	23.5%	507	105	20.7%

Attachment B.2: Replicate Test Results for Container SR164760

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \|\chi^2\|$)	t	Pr($x < \|t\|$)
	Reported Value	Absolute Uncertainty							
^{233}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{234}U Activity (Ci)	1.28E-06	2.64E-07	1.36E-06	1.22E-07	8.9%	0.848	0.932	-0.617	0.571
^{238}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{238}Pu Activity (Ci)	7.23E-03	1.50E-03	7.72E-03	6.82E-04	8.8%	0.826	0.935	-0.651	0.551
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{242}Pu Activity (Ci)	2.21E-09	4.59E-10	2.36E-09	2.09E-10	8.9%	0.831	0.934	-0.644	0.555
^{241}Am Activity (Ci)	1.68E-05	2.68E-06	1.69E-05	2.70E-07	1.6%	0.041	1.000	-0.473	0.661
^{237}Np Activity (Ci)	3.92E-06	6.23E-07	3.86E-06	1.10E-08	0.3%	0.001	1.000	5.167	0.007
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
TRU Alpha Conc. (nCi/g)	483	100	516	46	8.8%	0.837	0.933	-0.590	0.587

Quantity of Interest	χ^2 Test	t Test
^{233}U Activity (Ci)	Not Applicable	Not Applicable
^{234}U Activity (Ci)	Not Significant	Not Significant
^{238}U Activity (Ci)	Not Applicable	Not Applicable
^{238}Pu Activity (Ci)	Not Significant	Not Significant
^{239}Pu Activity (Ci)	Not Applicable	Not Applicable
^{240}Pu Activity (Ci)	Not Applicable	Not Applicable
^{242}Pu Activity (Ci)	Not Significant	Not Significant
^{241}Am Activity (Ci)	Not Significant	Not Significant
^{237}Np Activity (Ci)	Not Significant	Highly Significant
^{90}Sr Activity (Ci)	Not Applicable	Not Applicable
^{137}Cs Activity (Ci)	Not Applicable	Not Applicable
TRU Alpha Conc. (nCi/g)	Not Significant	Not Significant

Attachment B.3: Replicate Data for Container SR176807

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{242}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{241}Am Activity (Ci)	5.98E-07	1.55E-07	25.9%	7.19E-07	1.76E-07	24.5%	6.83E-07	1.77E-07	25.9%
^{237}Np Activity (Ci)	3.68E-08	7.71E-09	21.0%	3.37E-08	7.25E-09	21.5%	3.65E-08	7.66E-09	21.0%
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
TRU Alpha Conc. (nCi/g)	0.027	0.007	24.5%	0.032	0.008	23.3%	0.031	0.008	24.5%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{242}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{241}Am Activity (Ci)	5.52E-07	1.37E-07	24.8%	6.37E-07	1.57E-07	24.6%	5.27E-07	1.31E-07	24.9%
^{237}Np Activity (Ci)	4.37E-08	9.03E-09	20.7%	3.64E-08	7.76E-09	21.3%	3.38E-08	7.19E-09	21.3%
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
TRU Alpha Conc. (nCi/g)	0.026	0.006	23.1%	0.029	0.007	23.3%	0.024	0.006	23.6%

Attachment B.4: Replicate Test Results for Container SR176807

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \|\chi^2\|$)	t	Pr($x < \|t\|$)
	Reported Value	Absolute Uncertainty							
^{233}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{242}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{241}Am Activity (Ci)	5.98E-07	1.55E-07	6.24E-07	8.26E-08	13.2%	1.135	0.889	-0.283	0.791
^{237}Np Activity (Ci)	3.68E-08	7.71E-09	3.68E-08	4.08E-09	11.1%	1.118	0.891	-0.004	0.997
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
TRU Alpha Conc. (nCi/g)	0.027	0.007	0.0280	0.003	12.4%	1.109	0.893	-0.266	0.803

Quantity of Interest	χ^2 Test	t Test
^{233}U Activity (Ci)	Not Applicable	Not Applicable
^{234}U Activity (Ci)	Not Applicable	Not Applicable
^{238}U Activity (Ci)	Not Applicable	Not Applicable
^{238}Pu Activity (Ci)	Not Applicable	Not Applicable
^{239}Pu Activity (Ci)	Not Applicable	Not Applicable
^{240}Pu Activity (Ci)	Not Applicable	Not Applicable
^{242}Pu Activity (Ci)	Not Applicable	Not Applicable
^{241}Am Activity (Ci)	Not Significant	Not Significant
^{237}Np Activity (Ci)	Not Significant	Not Significant
^{90}Sr Activity (Ci)	Not Applicable	Not Applicable
^{137}Cs Activity (Ci)	Not Applicable	Not Applicable
TRU Alpha Conc. (nCi/g)	Not Significant	Not Significant

Attachment B.5: Replicate Data for Container SR526246

Quantity of Interest	Original Measurement			Replicate #1			Replicate #2		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{242}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{241}Am Activity (Ci)	5.32E-05	8.68E-06	16.3%	4.70E-05	7.69E-06	16.4%	4.57E-05	7.49E-06	16.4%
^{237}Np Activity (Ci)	3.49E-04	5.49E-05	15.7%	3.26E-04	5.12E-05	15.7%	3.23E-04	5.07E-05	15.7%
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
TRU Alpha Conc. (nCi/g)	29.2	4.0	13.8%	27.0	3.8	13.9%	26.7	3.7	13.9%

Quantity of Interest	Replicate #3			Replicate #4			Replicate #5		
	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty	Reported Value	Absolute Uncertainty	Relative Uncertainty
^{233}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{242}Pu Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{241}Am Activity (Ci)	4.73E-05	7.78E-06	16.4%	5.21E-05	8.51E-06	16.3%	4.98E-05	8.17E-06	16.4%
^{237}Np Activity (Ci)	3.24E-04	5.09E-05	15.7%	3.26E-04	5.12E-05	15.7%	3.26E-04	5.12E-05	15.7%
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	N/A
TRU Alpha Conc. (nCi/g)	26.9	3.7	13.9%	27.4	3.8	13.7%	27.2	3.8	13.8%

Attachment B.6: Replicate Test Results for Container SR526246

Quantity of Interest	Original Measurement		Sample Mean	Sample Standard Deviation	Relative Standard Deviation	χ^2	Pr($x < \chi^2$)	t	Pr($x < \|t\|$)
	Reported Value	Absolute Uncertainty							
^{233}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{234}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{238}U Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{238}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{239}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{240}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{242}Pu Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{241}Am Activity (Ci)	5.32E-05	8.68E-06	4.84E-05	2.55E-06	5.3%	0.347	0.987	1.722	0.160
^{237}Np Activity (Ci)	3.49E-04	5.49E-05	3.25E-04	1.41E-06	0.4%	0.003	1.000	15.492	0.000
^{90}Sr Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
^{137}Cs Activity (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
TRU Alpha Conc. (nCi/g)	29.2	4.0	27.0	0.3	1.0%	0.018	1.000	6.527	0.003

Quantity of Interest	χ^2 Test	t Test
^{233}U Activity (Ci)	Not Applicable	Not Applicable
^{234}U Activity (Ci)	Not Applicable	Not Applicable
^{238}U Activity (Ci)	Not Applicable	Not Applicable
^{238}Pu Activity (Ci)	Not Applicable	Not Applicable
^{239}Pu Activity (Ci)	Not Applicable	Not Applicable
^{240}Pu Activity (Ci)	Not Applicable	Not Applicable
^{242}Pu Activity (Ci)	Not Applicable	Not Applicable
^{241}Am Activity (Ci)	Not Significant	Not Significant
^{237}Np Activity (Ci)	Not Significant	Highly Significant
^{90}Sr Activity (Ci)	Not Applicable	Not Applicable
^{137}Cs Activity (Ci)	Not Applicable	Not Applicable
TRU Alpha Conc. (nCi/g)	Not Significant	Highly Significant